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ECL-1009

DESIGN OF A QUICK DISCONNECT FLUID COUPLING

by Carl A. Covington*

Summary

This case presents the story of the design of a quick disconnect fluid coupling. The design engineer found that a rival manufacturer was infringing his patent on this coupling, and he promptly ordered this organization to cease production of these devices. Through a sequence of coincidences a local patent attorney was asked to find an inventor to get around this patent, and he introduced the original design engineer to the owner of the infringing company. When the inventor learned that the infringement had been carried out inadvertently, he agreed to try to design a new coupling to meet more stringent new requirements--of holding high pressure or vacuum--and at the same time to get around his own and other patents. The manufacturer had one other almost impossible request--he wanted the new design on the next day so that he could start production on the accumulated orders he held for couplings.

This case presents the considerations of the design engineer for meeting the new design objectives and his solution to the design. It also presents the patent description and the reasoning for obtaining this new patent. It also presents a short discussion on the royalties for such patents.

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Part I:

A. Introduction -- by William Bollay

During a recent visit to Washington, I called upon my old friend, Carl Covington, who is currently employed as a project engineer for the Department of Defense on advanced strategic weapons systems. I had known him since we served together in the Navy during World War II. I remembered that he had for many years been a prolific inventor. In his youth, when he lived on a farm in Virginia, he had been very much interested in mechanical devices and innovations. While still a student at George Washington University he had invented a wire-tying device for a hay-baler which was later adopted by a major farm implement company.

During our visit I asked him whether he had made any recent inventions which involved both a good story and an interesting technical design. He reached into his desk drawer and pulled out a small gold-plated device and said "This is the 100,000th unit of a quick-disconnect fluid coupling which I designed for a Cleveland manufacturer. It is used to connect high pressure lines carrying toxic chemicals and must, therefore, have a very low probability of leakage. The design of this gadget involved some rather trying circumstances. I had to carry out the basic design in less than a day -- I had to get around my own and other existing patents -- and, in addition, I had to come up with a novel design for which a patent would be issued."

The case which follows is Carl Covington's story.

B. Carl Covington's Story:

1. Background

In 1948 I had the good fortune to become associated with Mr. Clarence Earle, recently retired Chief Chemist for the Navy. He was a successful inventor of chemical products, including lithium sterate grease. Mr. Earle had formed a small manufacturing company, called Baltimore Research Engineering Company (BRECO) with a limited technical staff. As he needed some technical assistance and also

new products for manufacture, I became a consultant to him in both areas.

Fluid couplings were just beginning to be used extensively at this time and promised to be a growing field, so I designed and obtained patents on five or six types of couplings which were manufactured by Mr. Earle's company on a limited scale.

The couplings were well received among prospective customers but the numerous production and distribution problems which plagued the company hampered the efficient marketing of the product. Frequently new prototypes fulfilling unique design requirements were made and given to salesmen to show to prospective customers without being marked with the manufacturer's name or patent designation. There was also a high turnover rate among BRECO salesmen. None were technically trained and few had the requisite ability to inform customers of the full uses of the fluid couplings.

These problems were compounded by the sudden death of Mr. Earle in 1951. The company was unable to operate without Mr. Earle's guidance and as a result sold its products to Perfecting Services Company (PSC), a reputable manufacturer with an established sales force and nation-wide distribution. Perfecting Services purchased BRECO to obtain access to the patents, know-how and rights of the couplings and other products BRECO held. Being an aggressive company they put the products on the market quickly and in large quantities.

About two years after the PSC takeover, a coupling identical to one of mine (see figures 1 to 5 of Patent 23,120 in Appendix I) appeared on the market and was brought to the company's attention. PSC notified me immediately that one of my patents was being infringed upon by Crawford Fitting Company and that legal steps were being taken to halt it. The Crawford Fitting Company was surprised to learn of their patent infringement and discontinued manufacture immediately.

Several weeks later, my patent attorney, Mr. Raymond Colton, of Washington solicited my assistance in the case of a fellow attorney whose client urgently needed the design for a new mechanical product. A meeting between the client and myself was arranged at my attorney's office and the client turned out to be Mr. Fred Lennon, President of Crawford Fitting Company, the firm which had been infringing upon my patent. My initial indignation was quickly allayed by Mr. Lennon's explanation. His company was engaged in making tube fittings, unions, and other related equipment, and he was anxious to add a hydraulic coupling to his line. He had visited the DuPont Company and was shown a prototype coupling left by a BRECO representative long before. The prototype carried no markings and was assumed to be a non-patented item. Mr. Lennon subsequently began its manufacture and included it in his catalogue of hydraulic devices. When he received a letter from PSC ordering him to stop production he did so immediately, but now was in need of a replacement to fill the backlog of orders which had been received.

My initial suspicion changed to sympathy as Mr. Lennon unfolded the problem which confronted him. When I asked for a month in which to work up an alternate design for him, he replied that he needed it immediately -- tomorrow. Although he was asking the impossible I assured him I would do my best.

Going home at 2 P.M. I locked myself in my study and began my task. I sketched out design after design, throwing out those whose concepts were difficult and complicated to manufacture. I also had to design around my own patents which were held by PSC. The coupling for Mr. Lennon was supposed to carry high pressure (7,000 lbs. per square inch) and low vacuum without modification and must have good fatigue characteristics, because it had to operate in a vibrating environment. It should not be subject to clogging. With my background in design I knew which concepts were most useful. I

went to the drawing board and put down, step by step, the requirements which I thought the coupling must meet. I worked far into the night making revision after revision until an acceptable design emerged. I presented Mr. Lennon with a drawing the following day which he accepted and put into production within a few months.

2. Technical Problems:

One never (or seldom) is given an assignment that does not have problems. If there were no problems, it is unlikely that projects would fall into inventors' hands in the first place. This project was no exception.

The coupling was being designed for a company, Crawford Fitting Company, whose president, Mr. Fred Lennon, insisted that every item in his catalog conform to the highest standards of quality. He impressed upon me that in order for the coupling to qualify for sale by his organization, it must lend itself to quality production as well as be pleasing in appearance.

Prior to starting the project, I considered, of course, the overall assignment, but I also formulated specific conditions which the design must meet in order that the new proposal be acceptable:

1. Ideally, it must be leak-proof for either vacuum or pressure in the connected or unconnected positions. Modifications, if required to hold pressure and vacuum should be limited to seals only.

2. It must withstand severe vibrations for such use as instrumentation lines to jet engines during test cell run up.

3. It must be possible to connect or disconnect while under pressure without the aid of tools.

4. A check valve should be provided on the socket end.

5. The parts must be adaptable to automatic screw machines for manufacture.

6. The components must be easy to assemble largely using automatic equipment.

7. The coupling must be operable with one hand.

8. Visible inspection should be sufficient to determine if the plug is in position and locked.

9. It should be pleasing in appearance.

C. First Class Assignment

Study the original coupling described in patent 23,120 of Appendix D. Sketch and describe alternate ways of accomplishing the same functions.

D. Appendix to Part I

Earle - Covington Patents: June 14, 1949 - Re 23,120

Reissued June 14, 1949 **Re. 23,120**

UNITED STATES PATENT OFFICE

23,120

COUPLING

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Original No. 2,463,253, dated March 1, 1949, Serial No. 743,986, April 25, 1947. Application for reissue March 25, 1949, Serial No. 83,506

14 Claims. (Cl. 285—169)

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Whereas snap couplings adapted for one hand assembly and disassembly have been proposed in the past, they have been characterized in general by an inordinate number of parts rendering their assembly difficult and their maintenance costly.

A continued need has existed for a coupling having few operating parts with which a fluid tight seal can be effected and maintained while permitting relative rotation of the joint members.

In accordance with the present invention it is sought to provide such a coupling comprising a joint member, a detent and a detent actuating sleeve carried by the member, a detent operator interposed between and normally projecting beyond the member and sleeve, and another joint member providing an abutment engageable with the operator when the members are coupled. The member carrying the detent and sleeve may be a socket member while that providing the abutment may assume the form of a plug member. The detent of the proposed invention is preferably normally released and advanced to a latching position as result of engagement between the abutment and detent operator. The operator is preferably biased towards its projecting position, the biasing means being at least partially overcome by engagement of the abutment with the operator so that the detent will be resiliently urged towards its securing position upon the attainment of registry between the detent and a cooperating recess provided by the second member. The sleeve is preferably provided with a cam secured thereto for engaging the detent, which cam may be of annular configuration and integral with the sleeve. The detent may assume the form of one, but preferably a plurality of radially displaceable balls received in a corresponding number of radial perforations provided through the wall of the detent carrying member. Means is also provided for biasing the sleeve towards a detent advancing position. The biasing means will preferably assume the form of a compression spring interposed between the detent bearing member and the operator and a second compression spring concentric therewith occupying a common chamber, and interposed between the sleeve and the operator. One of the members is provided with an annular groove for the reception of a sealing element, which may assume the form of a rubber or rubber like gasket of the type known as an O-ring, which is generally of toroidal shape for engagement with a cooperating portion of the other member.

Upon a coupling operation of the joint members, advancing movement of the detent will be restrained at the outset, the abutment bearing upon the operator to compress the springs seated thereon until the recess or annular groove assumes registry with the detent, whereupon the spring interposed between the operator and sleeve will urge the latter in a direction to advance the detent to a seating position and prevent retrograde movement of the detent until the members are uncoupled. During the coupling operation, the sealing gasket will be deformed to produce a fluid tight seal.

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The assembly of the sleeve and operator upon the joint member supporting them is preferably effected by means of retainer rings, and where such rings are of the tension type, they may assume the form of stressed rubber annuli seated in a groove, the annuli having an internal diameter normally less than that of the groove and an effective external diameter greater than that of the abutment defined on the element to be retained.

Uncoupling operation is effected by merely shifting the sleeve in a direction towards the abutment bearing member to release the detent, whereupon the spring interposed between the other member and the detent operator will eject the abutment bearing member to an uncoupled position.

A more complete understanding of the invention will follow from a more detailed description in connection with the accompanying drawings wherein:

Fig. 1 is a fragmentary elevation of the members in coupled relationship;

Fig. 2 is a fragmentary sectional elevation of the members in uncoupled condition;

Fig. 3 is a fragmentary sectional elevation of the members in one of the positions assumed during a coupling operation;

Fig. 4 is a fragmentary sectional elevation of the members in coupled relationship; and

Fig. 5 is a fragmentary sectional elevation of the members during the primary stages of an uncoupling operation.

The coupling comprises a socket member 10 supporting a reciprocable sleeve 12 and having external threads 14 provided at its free end. The sleeve may be provided with knurling 16 or other suitable gripping means to facilitate movement by an attendant. An annular detent operator 18 is interposed between the socket member 10 and sleeve 12 and projects outwardly therefrom for cooperation with an abutment 20 provided on a plug member 22 intended for insertion in

the socket member. The plug member may likewise be provided with knurling 24 to facilitate engagement by an attendant and external threads 26 may be provided at its free end.

With reference to Figs. 2 to 5 inclusive, the socket member is provided with a suitable number of inwardly converging radial perforations 28, four having been indicated for convenience, for the reception of a corresponding number of detents or balls 30 of such a size as to project through the wall of the member without passing completely therethrough. The socket member is provided with an internal annular groove 32 for the reception of a sealing gasket 34 depicted as generally toroidal in shape and composed of rubber or rubber like material so as to be resiliently deformable under the pressure of a cooperating portion of the plug member to constitute a seal between the members. A peripheral shoulder 36 is provided externally of the socket member longitudinally intermediate its internal groove 32 and its radial perforations 28 to limit movement of the sleeve 12 in one direction. The plug receiving end 38 of the socket is externally reduced to define a shoulder 40 which serves as a bearing surface for a helical compression spring 42 embracing its reduced end 38.

The sleeve 12 is provided with an integral annular cam 44, terminated at one side by a radial shoulder 46 which cooperates with the peripheral shoulder 36 to limit movement of the sleeve in one direction, the other side of the cam terminating in a cylindrical surface 48 which engages and confines the balls under coupled conditions. The internal wall of the sleeve is counterbored to define a recess 50 for the receipt of one end of a helical compression spring 52 concentric with the compression spring 42 of smaller diameter though somewhat greater strength. Due to the formation of the recess 50, the sleeve is provided with a longitudinal flange or projection 54 which serves to maintain the adjacent ends of the springs in spaced relationship.

The opposite ends of these springs bear upon the internal end of the operator 18 being maintained in spaced relationship by a reduced longitudinal flange 56 formed on the operator. The operator is retained on the reduced end of the socket member by means of a stressed rubber annulus 58 of generally toroidal form received in an annular groove 60 provided near the end of the socket member. The operator is retained with respect to the sleeve by means of a segmental metallic ring 62 received in an internal groove 64 near the end of the sleeve.

The plug member 22 is provided with an inclined sealing surface 66 for engagement with the gasket 34 which surface intersects a slightly tapered external wall 68 which is received by a complementary surface 70 formed internally of the socket member. The tapered wall 68 extends to an annular groove 72 formed externally on the plug member to receive the balls 30 under coupled conditions. The radial portions 74 of this groove converge inwardly to produce a jamming action should there be any tendency towards relative longitudinal movement of the members when they are coupled.

To assemble the components of the socket member, the balls will first be positioned in their radial openings and temporarily held therein by means of a heavy grease, whereupon the sleeve 12 is applied over the end of the socket member to retain the balls during the completion of the assembly. The springs are then inserted between the sleeve and socket member, following which the operator is inserted and the retainer rings applied to their respective seats. At some suitable phase of the assembly, the sealing gasket 34 is positioned in its groove. The operation of the coupling will be clearly understood upon reference to Figs. 2 to 5 inclusive depicting some of the various stages of a coupling and uncoupling operation.

In Fig. 2 the components of the socket member are shown in their normal positions before the plug 22 is inserted. In Fig. 3 the plug has been partially inserted into the socket, the tapered wall 68 of the plug preventing inward movement of the balls despite the fact that the abutment 20 is bearing upon the operator 18 to compress the springs 42 and 52. Further movement of the plug into the socket results in additional compression of these springs so that when the groove 72 registers with the balls 30, the sleeve 12 will snap to the left under the action of the spring 52 causing the cam surface 44 to force the balls into the groove to be confined in that position by the cylindrical surface 48. The coupled condition of the members is depicted in Fig. 4 where it will be noted that the spring 42 is under compression and the operator 18 unseated or depressed with respect to its normal uncoupled position. Consequently, when the sleeve 12 is shifted to the right, the first portion of which movement has been illustrated in Fig. 5, as soon as the cam surface 44 permits the balls 30 to ride up on the inclined radial portion of the groove 74 to release the plug, the operator 18 will be projected by its spring 42 to bear against the abutment 20 to eject the plug sufficiently to move its detent receiving groove out of registry with the detent.

Thus, it will be seen that the coupling of the present invention is susceptible to and well adapted for one hand operation in both coupling and uncoupling movements, assuming of course, that the socket member 10 is relatively rigidly mounted at its threaded end.

Whereas only one form of the invention has been illustrated in the drawings, it will be clear to those skilled in the art as it has already occurred to the present inventors, how the invention can be applied in other structural forms, and accordingly, the invention should not be restricted to the example beyond the scope of the appended claims.

We claim:

1. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

2. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, means biasing said operator towards its projecting position, and a second joint member providing an abutment engageable with said operator to overcome said biasing means and advance said detent when said members are coupled.

3. A coupling comprising a joint member, a de-

tent and a detent actuating sleeve carried by said member, a cam secured to said sleeve for engagement with said detent, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

4. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, an annular cam integral with said sleeve for engagement with said detent, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

5. A coupling comprising a joint member, a plurality of radially displaceable balls constituting a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

6. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, means biasing said operator towards its projecting position and said sleeve towards said detent, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

7. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, a spring interposed between said member and operator, a spring interposed between said sleeve and operator, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

8. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, concentric compression springs interposed between said operator and said member and sleeve respectively, and a second joint member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

9. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a

second member, a second joint member having a detent receiving recess and providing an abutment in bearing relationship with said operator when said members are coupled to actuate said detent, and a sealing element for engaging said members.

10. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, a second joint member having a detent receiving recess and providing an abutment engageable with said operator to advance said detent into said recess under conditions of registry when said members are coupled, said sleeve being movable towards said second member to release said detent and eject said second member.

11. A snap coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, a spring interposed between said operator and sleeve, a second joint member having a detent receiving recess and providing an abutment engageable with said operator to compress said spring until said detent and recess register when said members are coupled.

12. A coupling comprising a joint member, a detent and a detent actuating sleeve carried by said member, a detent operator interposed between and projecting beyond said member and sleeve prior to assembly of said member with a second member, a spring interposed between said operator and member, and a second joint member having a detent receiving recess and providing an abutment engageable with said operator when said members are coupled to actuate said detent, said spring projecting said operator and ejecting said second member upon movement of said sleeve to release said detent.

13. A joint comprising a pair of members, one receiving the other for relative sliding movement, an abutment provided by one of said members, the other of said members containing an external annular groove, and a stressed rubber annulus seated in said groove to limit relative sliding movement between said members, said annulus having an internal diameter normally less than that of said groove and an effective external diameter greater than that of said abutment.

14. A joint comprising a pair of members, one receiving the other for relative sliding movement, an abutment provided by one of said members, the other of said members containing an external annular groove, and a stressed rubber toroid seated in said groove to limit relative sliding movement between said members, said toroid having an internal diameter normally less than that of said groove and an effective external diameter greater than that of said abutment.

CLARENCE E. EARLE.
CARL A. COVINGTON.

No references cited.

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COUPLING

Original Filed April 25, 1947

Fig. 1.

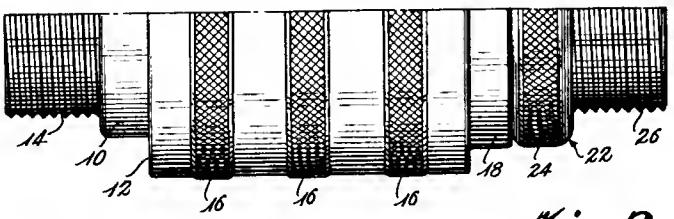


Fig. 2.

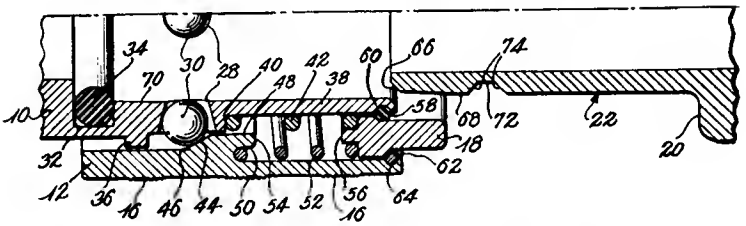


Fig. 3.

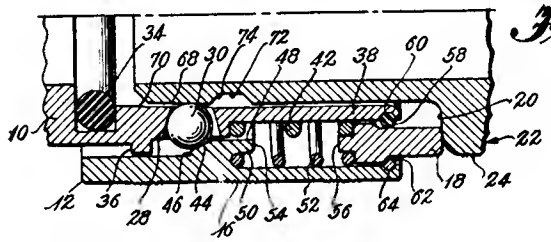


Fig. 4.

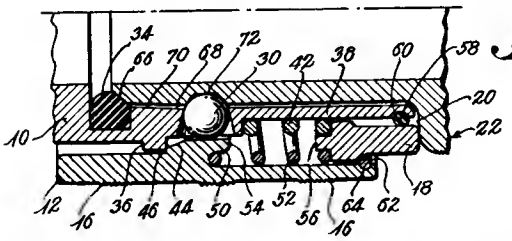
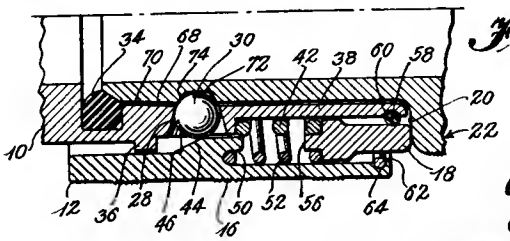


Fig. 5.



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Part II.

E. Design considerations used in developing the improved coupling.

The first consideration that one must give to the design of a fluid device such as a coupling is that of sealing against leakage when the two ends are mated or in contact. Where cut-off valves are used, as in this design, careful consideration must be given to a positive seal at one end when the two ends are separated. Also important to the design of a quick-disconnect coupling is the mechanical locking device. It is around this area that most of the patentable features of quick-disconnect couplings are drawn. The mechanical locking device is extremely important in that it must be simple, lend itself to automatic machine production, have a positive lock with visible means of determining that the device is locked, be operable with one hand and simple enough to meet cost competition.

Let us now consider separately each of the components that make up a new design. Not all fluid quick-disconnect couplings require a check-valve. This one, however, was to be designed around a single-end cut off valve. Handbooks are replete with check-valves of all kinds. I elected to use a ball check-valve for several reasons. It is cheap, has a continuous seating surface, will not tilt or cock sideways, is self-centering and is commercially available in a wide variety of sizes and kinds of material. After selecting a ball check-valve, I decided that it should be backed up by a spring facing the ball against an O ring with a teflon retainer. Teflon is an appropriate material for this purpose since it is inert, not affected by most fluids, has a very low coefficient of friction, and has cold flow characteristics which make it readily conform to a contour.

The primary seal is made by the O ring seating against the ball. Such an arrangement is simple and straight-forward when only positive pressure is applied to it, but if the valve is to be used for vacuum the problem becomes somewhat more difficult. The O ring must be positioned so that

it will not blow out. The wedging action of the O ring against the ball and the spring pressure in the ball must be sufficient to prevent lift-off. Appropriate selection of spring strength and O ring diameter as a function of the ball diameter will provide an adequate seal.

The next problem which I faced was that of a mechanical locking device, one that would lock automatically when the plug is inserted into the socket. It is here that I had to get around my previous patents. It appeared that a ball-detent locking against a groove in the plug would be the best arrangement. If close tolerances were maintained in this arrangement there would be very little fore and aft movement between the plug and socket when in the locked position. This is highly desirable.

Now that I had settled on how the plug and socket were to be held together, the next problem was that of providing a mechanism that would lock the ball-detent into place when the plug was inserted into the socket.

There are numerous ways to accomplish a locking action. However, most of them are bulky, difficult to assemble or subject to contamination. I concluded that two concentric sleeves on the socket would not be feasible because of the resulting larger diameter, heavier spring wire, and the difficulty with dimensional tolerances for such an arrangement.

After determining what could not be done, I turned my attention to approaches that appeared to lead me in directions that would result in an acceptable design. At this point one finds himself in a situation where theory, formulae and high-powered mathematics must yield to good judgement, common sense, and a bit of inventive ingenuity. At this time I resorted to the sketch pad and tried numerous combinations of sleeve designs and spring arrangements. Usually during the initial concept phase little attention is given to assembly problems or tool design requirements. They cannot be neglected altogether, however, but should be secondary to creating the concept of configuration. Once the kinematics are established, full attention should then be directed toward making the design practical.

That is, the designer must try to simplify wherever possible, and consider the man in the shop. A variety of questions immediately come to mind. Can the device be made with conventionally designed tools? Is it easy to assemble? Is it pleasing in appearance? Does it do the job? These are considerations that must be kept in mind during the entire process of design.

These considerations led me to a design using two concentric sleeves, but rather than having both on the socket, one sleeve was on the socket and the other sleeve on the plug. With this criterion established, I turned my efforts toward final details, such as spring sizes, retainer ring location and an appropriate configuration leading to a workable design that did not infringe upon other similar patents or my own earlier patents. The coupling which was finally derived is shown in Figure 1 and described in Part F.

F. Description of final design:

Figure 1 is a non-dimensional section of the coupling showing the components in relation to each other. Figure 2 is a cut-away of the same coupling shown in the connected or closed position.

Using Figure 1 as a reference, the coupling operates as follows:

Plug (1) is inserted into coupling body (2). As it enters, surface (3) pushes ball detent (9) radially away from the center. As the ball moves radially outward it holds sleeve (4) in the position shown, being constrained by the ball at inclined surface (10). As the plug moves further inward, sleeve (5) contacts sleeve (4) at (6) and (6'). Since sleeve (4) is restrained from moving by ball detent (9) against sleeve surface (10) sleeve (5) moves away from retainer ring (21), thereby compressing spring (7). As the plug is moved further into the socket, spring (7) is compressed solid, at which time slot (8) coincides with the ball detent (9). When this position occurs, inclined plane (10) on body sleeve (4) drives the detents (9) toward the center into slot (8). Body sleeve (4) now moves to the right, covering detent (9) at surface (11) and held in that position

by spring (7), pushing against body sleeve (4) at (6) and (6'). It should be noted that spring (7) must have sufficient force to compress spring (12) and overcome sliding resistance of both sleeves and the ball detents.

The coupling is released or unlocked by manually sliding sleeve (5) back or away from the body, thereby compressing spring (7) and allowing spring (12) to move sleeve (4) back against retaining ring (22). This action allows detents (9) to move radially outward and away from slot (8). Surface (13) can be conspicuously marked or painted to allow visual inspection to determine if the coupling is closed and locked. Should any part of surface (13) be visible, the plug is not securely locked to the socket.

The shut-off valve is affected as follows: As plug (1) moves into sleeve (2) it must seal prior to opening the ball valve (15). This is accomplished by surface (3) of plug (1) contacting O ring (14) just prior to plug end (16) contacting ball (15) and moving it away from its seat on O ring (20). Further movement of plug (1) moves check ball (15) back and allows fluid to flow around the ball into holes (17) located at the rear end of plug (1). The annular area between ball (15) and inside of body (23) is slightly greater than hole (18). This technique allows a fairly high flow with minimum resistance. Holes (17) as shown are round. However, under some conditions when high viscosity fluids are used, it is necessary that they be elliptical or elongated and the edges broken. Spring (19) serves only to hold ball (15) against its seat under no-flow conditions. Bushing (24) provides a spacer between O rings (14) and (20) and helps to effect a seal for both vacuum and pressure by conforming to contour variations and providing a less than solid surface for the O ring to seat.

The type and kind of material used in the coupling is, of course, a function of the requirement to be imposed on the unit. The initial units were designed for an operating pressure of 7,000 psi and a vacuum of at least 10-5 inches of Hg with negligible leakage. The vacuum holding capability of the coupling is accomplished by proper arrangement of a teflon and rubber seal.

The groove into which O ring (20) is held is configured so that there is a fairly large wedging action against plug (1). By proper arrangement of teflon washers and O ring hardness, the seal will lie flat against the plug with no extrusion or pinching between parts.

The coupling is now being manufactured and made of brass and stainless steel. Brass units are for moderate pressures and stainless steel for higher pressures.

G. Patentable Features:

Patents are generally issued on the basis of something new and novel, but not necessarily useful.

The coupling which I designed for Crawford Fitting Co. had several features that were unique and enabled me to obtain a patent. These differences are apparent when one examines my earlier patents and those cited in the file of patent issue number 2,797,110, dated 25 June 1957.

1. In examining patent No. Re 23120 it is obvious that there is a great difference in the two designs, the major one being that the older patent has all the mechanism in the socket. The plug is simple and straight, requiring only a groove for locking and a shoulder at the end of the stem to actuate the lock. Figure 3 is the assembly drawing from which the first prototype of this design was made.

2. Fluid coupling Patent No. 2,674,469 is very simple in design. It requires but one spring and it is located in the plug. The only similarity to the Crawford coupling is that the releasing actions are identical; that is, the plug is held in the hand and the sleeve is pulled as though the plug is being pulled out. Sliding the sleeve away from the socket in both of these designs unlocks the mechanism.

3. Fluid coupling Patent No. 2,521,701 is unlike any of those described earlier. It has a floating ring inside the sleeve installed over the socket. The ring is identified as part 82 on the patent drawing. This design works quite well as long as there are no contaminants. Any debris

or sluggishness in the system renders the unit inoperative. It also has no positive means of visually determining if the two parts are locked. Should the spring fail to move the ring due to contamination or pressure by the ball, there is no convenient way to release the plug. It is, therefore, quite obvious that this compact and easy-to-build coupling never became a best seller.

H. License of the Use of Patents:

License agreements have a very wide range of variations. There is no fixed legal amount to be paid. The terms are generally negotiated. Establishing the amount of royalty to be paid for a patent is like bargaining for a new labor contract except the inventor is the only one on the patent side who stands to gain or lose. The licensee, on the other hand, must invest large amounts of money before he gains anything. He is also taking a risk by depending upon the novelty of the invention.

For purposes of royalty payments, there are generally two types of inventions: 1) the high volume type with low selling price, and 2) the low volume type with high selling price. The high volume product is usually a less expensive and more competitive item which, therefore, commands a lower royalty. On the other hand, low volume, high-cost items generally yield the inventor a somewhat greater income based on a percent of the selling price.

Royalties are sometimes paid on a unit basis, that is, a stipulated amount per unit. This is generally the case where the invention is a small component of an overall assembly or end product, in which case the exact cost is difficult to separate. Such an arrangement should take into account a cost-of-living adjustment or be based upon some type of cost-rise factor. Agreements for a percentage of a price automatically take the inflation factor into account. In this case no cost of living adjustment is necessary.

Where a percentage is the basis for royalties, one should be careful that he clearly understands what price the royalty is based upon. There are a number of prices and discounts labeled against a product from manufacturer to consumer. Generally a royalty is based upon manufacturer's selling price, but one must be careful that the manufacturer's selling price is truly a selling price, not a price invoiced to an intermediate holding company set up for the express purpose of holding down the price on which royalties are based.

It is important that a capable lawyer be consulted in writing a patent royalty agreement, but one should not forget that even the best lawyers sometimes omit or overlook aspects of agreements that can be costly to the inventor. Therefore, the more knowledgeable an inventor is regarding agreements, the better position he will be in to negotiate for the sale of his invention.

A word of caution should be given to every new and young inventor about asking too much for his invention. Do not forget that the manufacturer must make a profit or he cannot stay in business. A good agreement is one from which a fair and equitable profit accrues to all parties. The inventor who asks too much for his invention because he thinks it will revolutionize the world, is likely to be a good candidate for a disappointing future. An inventor must be realistic.

I. Royalties

How much royalty should one expect from his invention? The amount is one which must be negotiated. It is always best if an inventor can obtain a percentage of the value or cost of his invention. Generally 5% of the manufacturer's selling price is the basis for computing most royalties. Usually the more competitive the device the lower the rate. On some very large production items which have a low profit margin the royalty may go as low as 2%. Where royalties are based upon a percentage, the rise and fall of the market automatically adjust the income in proportion to the manufacturer's profits.

Where a fixed amount per item is agreed upon, changes in price can result in unfair royalties either to the manufacturer or inventor. This situation can be taken care of by introducing a cost of living adjustment into the agreement. Where a stipulated amount is paid per unit, the device is usually an integral component of some larger part which makes it difficult to compute royalties and define where the cost of the invention actually begins and ends. This was the situation with the quick-disconnect coupling which was combined with the Swage lock end-fittings shown in Figure 2.

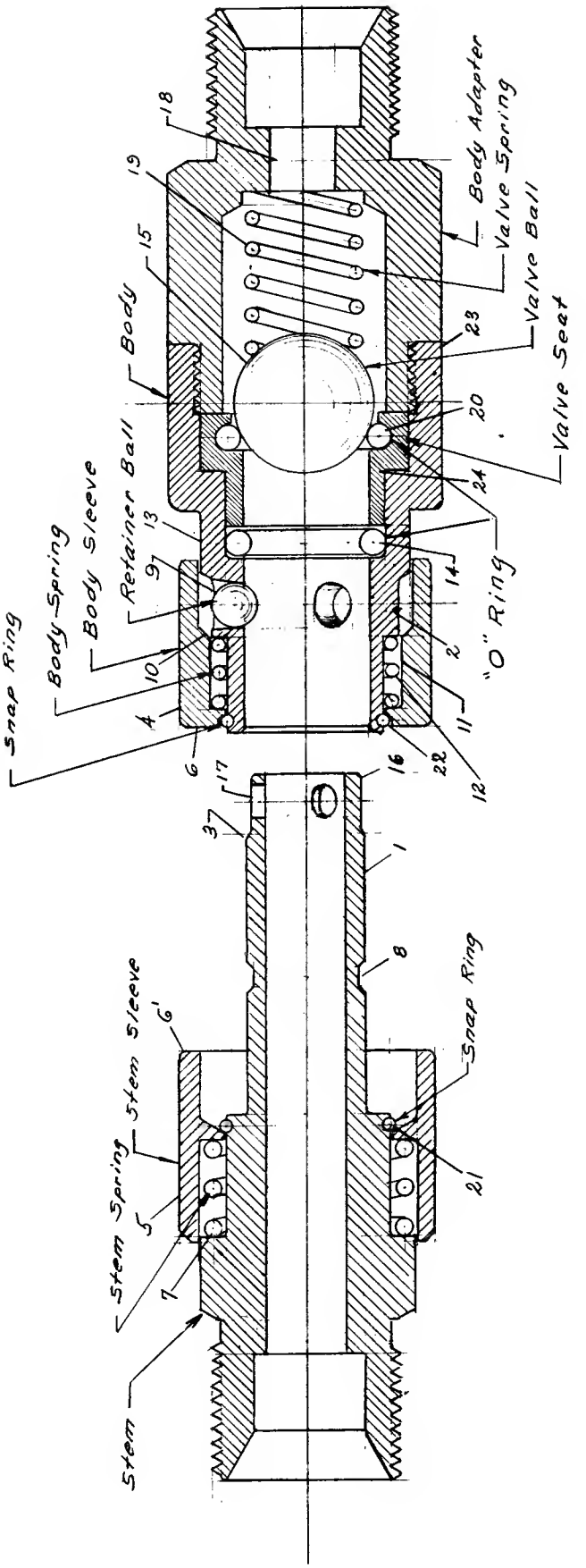
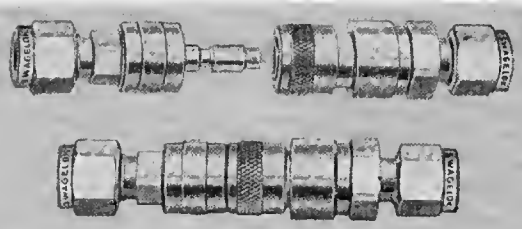
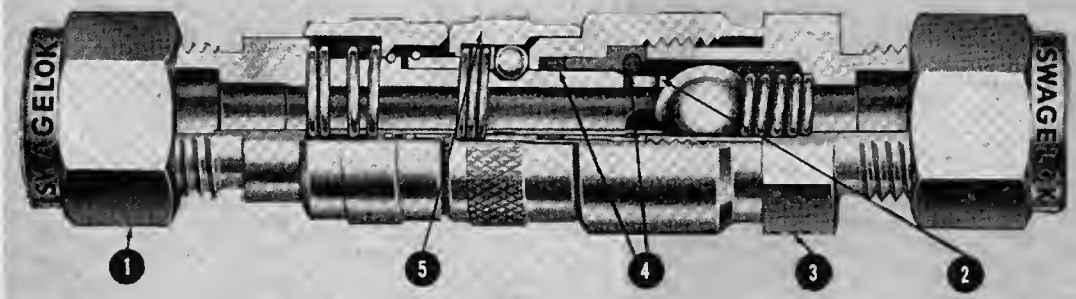


Figure 1 Now - Dimensional Section of Quick-Disconnect Coupling

Swagelok®





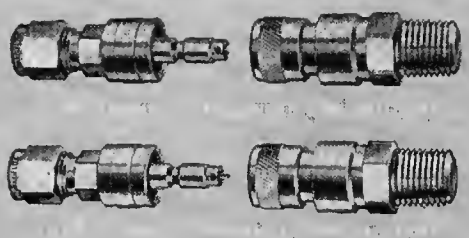
SWAGELOK Quick-Connects with single end or double end shut-off for tube to pipe, tube to tube and bulkhead tube to tube applications are available in brass and stainless steel in sizes for ¼", ⅜" and ½" O.D. tubing.

Flow resumed instantly and vacuum tight seal assured when connection is made.

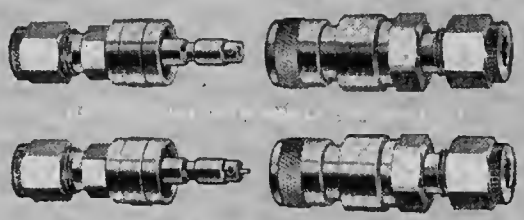
Light, compact, streamlined design. Occupies little space. For use with portable equipment and bulkhead or panel applications.

Instant-acting seals prevent loss of fluid when fitting is disconnected.

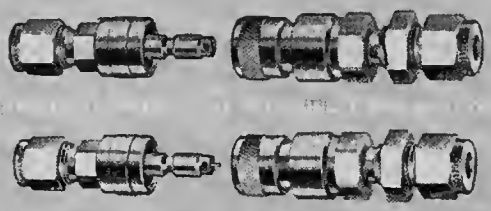
No twisting, turning or wrench action necessary. Easy straight-line fingertip pull or push action for instant connecting or disconnecting.



Quick-Connects can be used with metal as well as plastic tubing.



QUICK-CONNECT WITH SINGLE END SHUT-OFF
SWAGELOK Quick-Connects are suggested for use with portable equipment and bulkhead panel applications. They are furnished through local distributors in sizes for ¼", ⅜" and ½" O.D. tube, available in stainless steel and brass. The SWAGELOK Quick-Connect Fitting is normally furnished with Buna "N" O-Rings. Other O-Ring materials are available for special applications.



QUICK-CONNECT WITH DOUBLE END SHUT-OFF
SWAGELOK Quick-Connects with unique double end shut-off, for use on hydraulic or pneumatic lines, contain instant acting seals in both parts of the unit which completely prevent loss of any pressure from either end of the line when the fitting is disconnected. Flow is resumed instantly when the male and female units (stem assembly and body assembly) are connected.

The SWAGELOK end of the Quick-Connect is assembled on the tube the same as any standard SWAGELOK Fitting. No special preparation of the tubing is necessary.

Crawford Fitting Company / 29500 Solon Road / Solon, Ohio 44139
Crawford Fittings (Canada), Ltd. / Niagara Falls, Ontario, Canada

Figure 2 Cut-Away of Quick-Disconnect Coupling

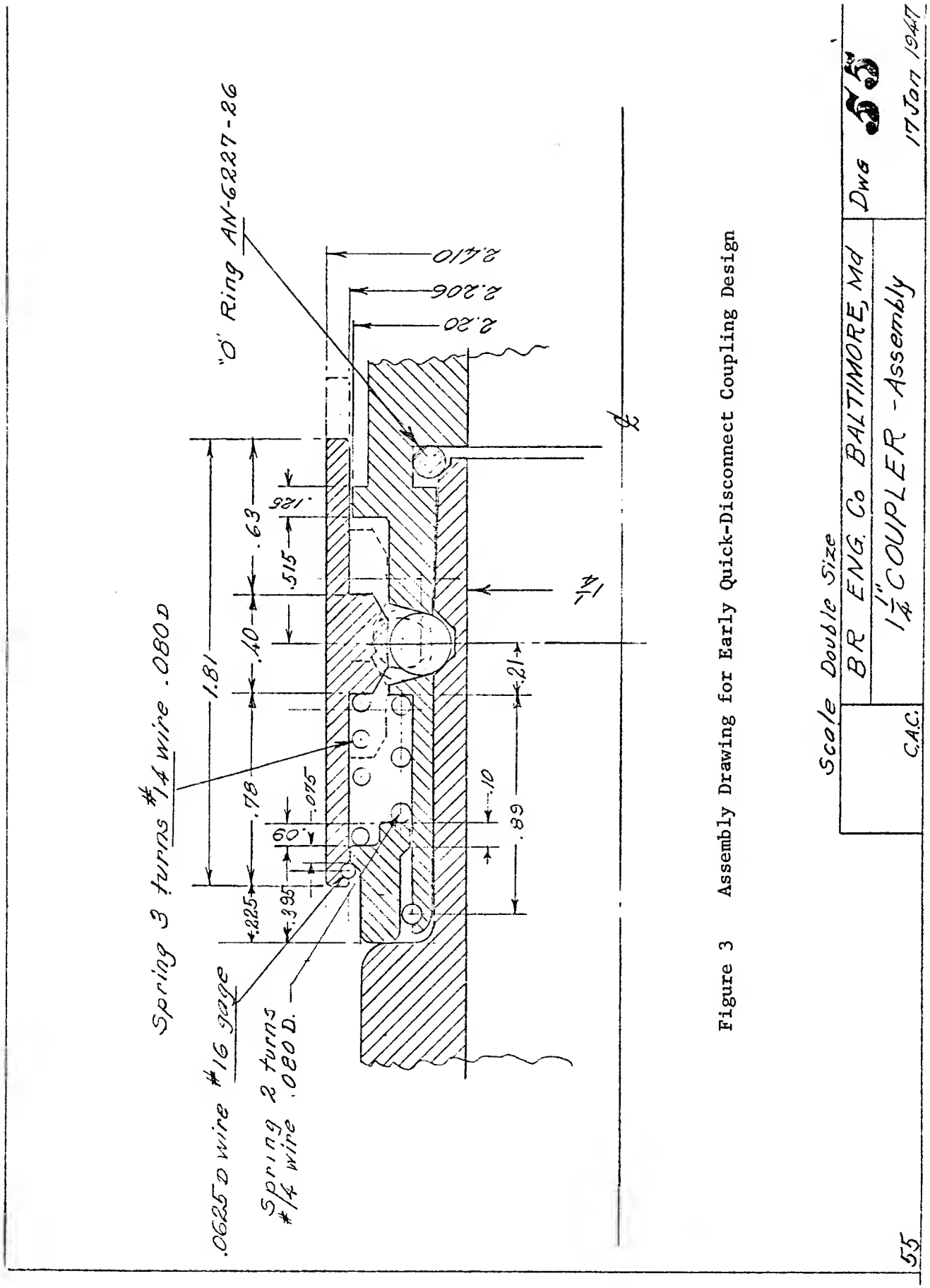


Figure 3 Assembly Drawing for Early Quick-Disconnect Coupling Design

United States Patent Office 2,797,110 Patented June 25, 1957

2,797,110

BALL DETENT COUPLING

Carl A. Covington, Alexandria, Va.

Application April 4, 1956, Serial No. 576,146

7 Claims. (Cl. 285—86)

This invention relates to a coupling of the plug and socket type.

The coupling of the present invention has been designed to produce a positive action, ease of assembly and yet the major parts can be produced on an automatic screw machine. Thus, production costs can be maintained at a minimum without sacrificing quality and performance.

The coupling comprises a socket member having an open end and a plurality of radial openings, a detent in each of the openings, a first sleeve slidably carried by the socket member having detent confining and detent releasing positions, the sleeve providing cam means engageable with the detents for imparting radially inward confining positions thereto, a first spring interposed between the socket member and sleeve biasing the sleeve towards a detent releasing position, a plug member having an end receivable in the open end of the socket member and containing an external groove adapted to receive the detents, a second sleeve slidably carried by the plug member, the second sleeve having a bore adapted to receive the end of the socket member and a surface adapted to abut the first sleeve, and a second spring of greater force than the first interposed between the plug member and second sleeve biasing the second sleeve towards the first sleeve to overcome the force of the first spring during assembly of the members.

The end of the socket member extends beyond the adjacent end of the first sleeve in a preferred form of the invention and similarly, it is preferred that the end of the plug member extend beyond the adjacent end of the second sleeve. It is also preferred that the first sleeve enclose the first spring and the second sleeve enclose the second spring.

The coupling is eminently suited for use in fluid lines and under these circumstances, the members are tubular and a fluidtight packing is interposed between them. The socket member under such circumstances preferably contains an internal groove and a pressure packing is supported in the groove for engagement with the end of the plug member under assembled conditions.

A more complete understanding of the invention will follow from a detailed description of the accompanying drawings wherein:

Fig. 1 is a fragmentary sectional elevation depicting a coupling according to the present invention in assembled condition;

Fig. 2 is an elevation of a coupling of the type shown in Fig. 1;

Fig. 3 is a fragmentary sectional elevation showing the relationship of parts at the beginning of a coupling operation;

Fig. 4 is a fragmentary sectional elevation showing the relationship of parts at an intermediate stage of a coupling operation; and

Fig. 5 is a section taken along line 5—5 of Fig. 1.

A socket member **10** is shown as having external threads **12** formed on one end thereof and having a

groove **14** adjacent its other end **16** to receive a retaining ring **18**. The socket member is provided with a plurality, preferably an odd number, of frusto conical radial bores or openings **20** for the reception of detents **22** depicted as balls. Intermediate the bores and the threaded end of the socket member, a cylindrical surface **24** is formed to serve as a guide for a complementary surface **26** formed on a sleeve **28**. Between the bores **20** and the groove **14**, the socket member is formed with a reduced cylindrical surface **30** which defines with a reduced surface **32** of the sleeve **28**, a chamber for the reception of a helical spring **34** whose ends are interposed between a shoulder **36** on the socket member and a shoulder **38** on the sleeve biasing the sleeve towards the limiting position provided by the resilient ring **18** so that the detents **22** will tend to receive a released position as depicted in Figs. 3 and 4.

The plug member **40** is provided with internal threads **42** at one end, its opposite end **44** projecting into the socket member **10** for engagement with a fluid packing **46** suitably supported in an annular groove **48** formed internally of the socket member. The plug member is provided with an external groove **50** having inclined sides **52** and **54** which cooperate with the detents **22**. Between the groove **50** and the threaded end of the plug member **40**, another groove **56** is provided for the reception of a resilient ring **58** serving as a stop for a sleeve member **60** whose counterbore **62** cooperates with the cylindrical surface **64** of the plug member to define a housing **66** for a spring **68** having a force exceeding that of the spring **34** housed between the socket member **10** and its sleeve **28**.

Intermediate the reduced surface **32** of the sleeve **28** for confining the detents radially inwardly and the enlarged surface **26** thereof which permits the detents to move outwardly in their released positions, a cam surface **70** is provided for bearing engagement with the detents so as to transmit the force tending to confine them.

As viewed in Fig. 3, the end **44** of the plug member **40** has been introduced into the open end of the socket member **10** to a point just before the leading end **72** of the sleeve **60** abuts the leading end **74** of the sleeve **28**. Under these conditions, both springs **34** and **68** are fully extended. As the plug member **40** is moved farther into the socket member **10**, the leading end **72** of the sleeve **60** abuts the leading end **74** of the sleeve **28**, imposing the force of the spring **68** upon the detents **22** tending to direct them inwardly because of the inclination of the cam surface **70**. However, the surface **76** formed on the leading portion of the plug member **40** prevents inward movement of the balls so that the spring **68** becomes compressed as depicted in Fig. 4. This compression, and of course movement of the sleeve **60**, continues until the groove **50** registers with the detents **22** whereupon the spring **68** expands forcing its sleeve **60** forwardly and the sleeve **28** to the right as viewed in the drawings, compressing the weaker spring **34**, driving the detents **22** inwardly and latching them in the groove **50** by means of the reduced portion **32** of the sleeve **28**.

To disengage the members it is only necessary to retract the sleeve **60** on its plug member **40** against the force of the spring **68** until the weaker spring **34** shifts the sleeve **28** towards the resilient ring **18** carried by the socket member **10**, releasing the balls and permitting retraction of the plug member from the socket member.

The resilient rings **18** and **58** may be split metallic rings or continuous rubber rings or may assume such other forms as are consistent with proper operation and low cost. The packing **46** may assume various forms of which there are many commercially available. The

sleeve 28 is shown as provided with knurling 78 to facilitate its operation, it being understood that release of the parts may be accomplished by shifting the sleeve 28 against the force of the spring 68 as an alternative to retraction of the sleeve 60.

Whereas only one specific form of the invention has been shown and described, variations such as those as would be suggested to workers skilled in the art are contemplated. Accordingly, the invention should not be restricted beyond the scope of the appended claims.

I claim:

1. A coupling comprising a socket member having an open end and a plurality of radial openings, a detent in each of said openings, a first sleeve slidably carried by said socket member having detent confining and detent releasing positions, said sleeve providing cam means engageable with said detents for imparting radially inward confining positions thereto, a first spring interposed between said socket member and sleeve biasing said sleeve towards a detent releasing position, a plug member having an end receivable in said open end of said socket member and containing an external groove adapted to receive said detents, a second sleeve slidably carried by said plug member, said second sleeve having a bore adapted to receive said end of said socket member and a surface adapted to abut said first sleeve, and a second spring of greater force than the first interposed between said plug member and second sleeve biasing said second sleeve towards said first sleeve to overcome the force of said first spring during assembly of said members.

2. A coupling as set forth in claim 1 wherein said end of said socket member extends beyond the adjacent end of said first sleeve.

3. A coupling as set forth in claim 1 wherein said end of said plug member extends beyond the adjacent end of said second sleeve.

4. A coupling as set forth in claim 1 wherein said first sleeve encloses said first spring.

5. A coupling as set forth in claim 1 wherein said second sleeve encloses said second spring.

6. A coupling as set forth in claim 1 wherein said members are tubular and a fluid tight packing is interposed therebetween.

7. A coupling as set forth in claim 1 wherein said members are tubular, said socket member contains an internal groove, and a pressure packing is supported in said groove for engagement with said end of said plug member under assembled conditions.

References Cited in the file of this patent

UNITED STATES PATENTS

810,354	Scanlon	Jan. 16, 1906
2,377,812	Scheiwer	June 5, 1945

June 25, 1957 C. A. COVINGTON 2,797,110

BALL DETENT COUPLING

Filed April 4, 1956

FIG. 1

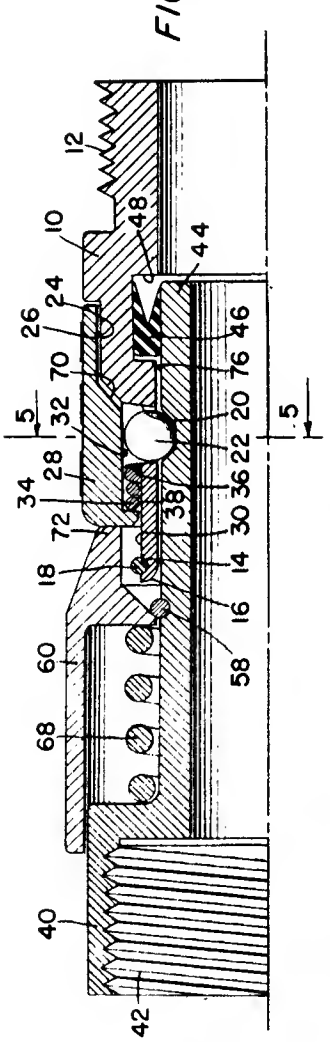


FIG. 3

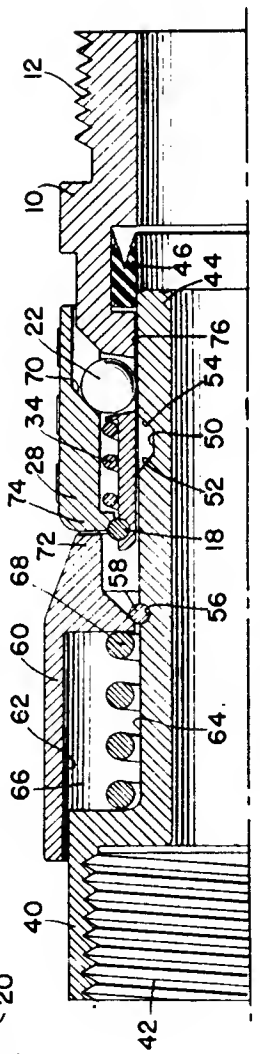


FIG. 4

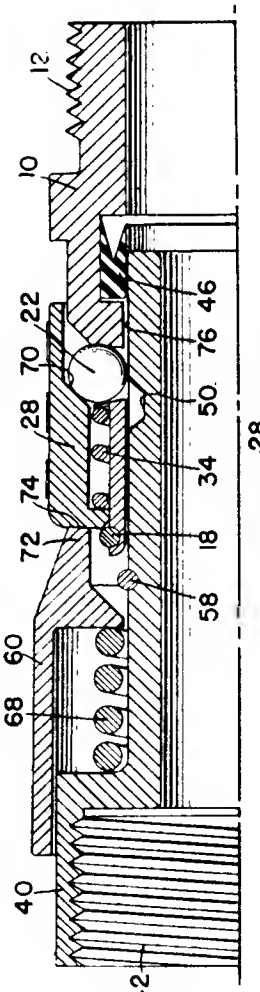


FIG. 2

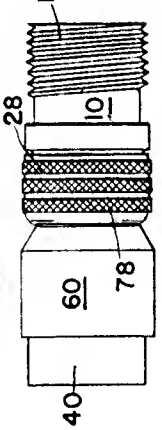
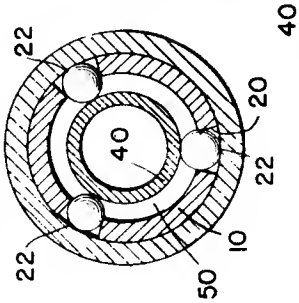


FIG. 5



INVENTOR

CARL A. COVINGTON

BY Raymond W. Cotton

ATTORNEY

Patented Sept. 12, 1950 2,521,701

UNITED STATES PATENT OFFICE

2,521,701

COUPLING

Clarence E. Earle, Washington, D. C., and Carl A. Covington, Arlington County, Va.

Application December 27, 1946, Serial No. 718,662

8 Claims. (Cl. 285—169)

1

Despite the great number of patents extant on the subject, the demand for a simple, inexpensive and satisfactory, quickly attachable and detachable coupling has not been fulfilled prior to this time.

One of the more recent efforts in this behalf is represented by the disclosure of the patent to Scheiwer, 2,377,812, dated June 5, 1945. In accordance with the present invention, a coupling has been created which possesses all of the advantages of the Scheiwer coupling and the disadvantages thereof have been obviated. The present structure is less expensive to produce, simpler to operate and assemble, has fewer exposed working parts and is well adapted for one hand operation during both assembly and separation of the coupling members with respect to one another.

The invention contemplates a coupling comprising two joint members, a detent carried by one of the joint members in normally released condition and means moved in one direction upon assembly of the members to operate the detent and secure the members, further movement of the means in the same direction releasing the detent. The means which is moved upon assembly of the members to operate the detent may be biased in one direction, which direction may be opposed to that in which it is moved upon such assembly, the biasing being accomplished by resilient and/or magnetic means. The means so moved upon assembly of the members may assume the form of a cam whose shape may be generally annular and whose operating surfaces may be spaced one from the other, so that such a cam may assume the form of a cylindrical surface interposed between a pair of inclined surfaces. A sleeve carried by one of the members may be moved in one direction upon assembly of such members to operate the detent and secure the members and such sleeve may have a portion interposed in the path of the other member for engagement during a coupling operation. The sleeve may likewise be biased in a direction opposed to that in which it is moved as result of a coupling operation. When the coupling members are assembled, the sleeve will preferably assume an intermediate position, which may be one of three positions assumed in the course of a complete coupling and uncoupling operation.

The detent may assume the form of a plurality of balls carried by one of the joint members, and such joint member may contain radial perforations to receive such balls. The detent actuating means preferably assumes a position for releasing the detent during assembly of the joint members, such actuating means being shifted to a position confining the detent by assembly of the members and having a third position for releasing the detent. The joint members may assume the form of a plug and a socket, in which case, the detent may be carried by the socket and the plug may contain a recess to receive the detent. The means for confining the detent in response to assembly of the members may have an intermediate position with respect to one of the members while the parts are assembled, being movable in either direction from such position to release the detent. A sleeve carried by one of the joint members may be biased in one direction with respect thereto, the sleeve in turn receiving a cam biased in another direction with respect thereto, the other member carrying means for shifting the sleeve during assembly of the members, such shifting increasing the bias on the cam to produce a snap action upon the detent when it registers with a recess, further shifting of the sleeve in the same direction serving to release the detent. To release the coupled members, movement of the detent actuating means is preferably in a direction away from the member which receives the detent only during coupled conditions.

2

By virtue of the arrangement of parts proposed herein for the first time, the joint members can be coupled or uncoupled by the use of one hand and with much greater facility than in the case of other known couplings by the use of two hands.

A more complete understanding of the invention will follow from a detailed description of the accompanying drawings wherein:

Fig. 1 is an elevation showing the parts in assembled relationship;

Fig. 2 is a sectional elevation taken along line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation similar to Fig. 2 wherein the external sleeve has been shifted to permit separation of the joint members;

Fig. 4 is a fragmentary sectional elevation indicating the relationship of parts prior to a coupling operation;

Fig. 5 is a sectional elevation similar to that of Fig. 2, showing the parts partially assembled in the positions they assume just prior to the actuation of the detent; and

Fig. 6 is a sectional elevation similar to that of Fig. 2 wherein the detent actuating means relies upon magnetic bias to seek its operative detent confining position.

The coupling depicted in the drawings comprises a socket member 10, a plug member 12 and a sleeve 14 carried by the socket member and capable of being reciprocated thereon. These members are depicted as being knurled at convenient points to facilitate gripping by the operator.

The socket member 10 is shown as having an externally threaded end 16 surrounding a bore

18 extending to a shoulder 28 constituting an abutment for a toroidal resilient packing 22 seated in an internal groove 24. Beyond the internal groove 24, the socket member provides an enlarged internal bore 26 adapted to receive a cooperating portion of the plug member. The external threads 16 on the socket member terminate at a radial shoulder 28, beyond which a substantially cylindrical portion 30 extends, provided with knurling 32, the knurling terminating at an annular groove 34, the cylindrical portion terminating at a shoulder 36. Beyond the shoulder 36, the socket member is provided with a reduced periphery 38, which is further reduced at an intermediate shoulder 40 to define a periphery 42, interrupted only near its end by an annular arcuate groove 44 adapted to receive a split retainer ring 46. Adjacent the shoulder 40, radial frustro-conical openings 48 are provided through the larger periphery of the socket member to receive detent means in the form of a plurality of balls 50, four such balls having been indicated in the drawings, the relative dimensions of the openings as compared with the balls being such that the latter cannot pass entirely through the openings, but portions thereof can extend inwardly beyond the inner wall of the socket member for engagement with the inclined walls 52 of an annular recess 54 provided intermediate the ends of the substantially cylindrical periphery 56 of the plug.

The forward end of the plug periphery 56 is beveled to form a substantially frusto-conical sealing surface 58 which terminally intersects a nipple 60 for projection into the packing 22. The other end of the plug periphery 56 terminates at a radial shoulder 62, beyond which the plug is enlarged externally to receive knurling 64 and internally to receive threads 66 and a packing element 68 seated at the base of the threads against an internal shoulder 78.

The sleeve 14 is externally substantially cylindrical, provided with knurling 72 and 74 near its respective ends. One end of the sleeve is internally bored to a diameter sufficient to clear the adjacent cylindrical portion 30 of the socket member 16. At an intermediate portion, the internal bore 76 is grooved arcuately to define a recess 78 to receive an annular split retainer ring 80 which functions to limit movement in one direction of a cam 82 with respect to the sleeve. As depicted in Figs. 2 to 5 inclusive, this cam is biased toward the retainer ring 80 by means of a compression spring 84 which bears against a shoulder 86 at which the internal bore 76 is terminated. The shoulder 86 extends radially inwardly to a diameter slightly larger than that of the periphery 42 of the socket member, but slightly smaller than that of the retainer ring 46 when arranged in its groove near the end of the socket member. Also bearing against the shoulder 66 is an independently operating compression spring 88 whose other end bears against the shoulder 48 formed between the peripheries 38 and 42 of the socket member. Beyond the radial shoulder 86, the sleeve is provided with a counterbore 90 extending to the open end of the sleeve, terminated by an abutment 92 whose internal diameter is somewhat smaller than the external diameter of the cooperating shoulder 62 formed at the enlarged end of the plug.

Upon reference to Fig. 4 of the drawings, depicting the joint members prior to assembly, it will be evident that under the influence of the spring 88, the sleeve 14 is normally biased towards

the left with respect to the socket member to a position which is limited by the retainer ring 46. It is also clear from this figure that by the action of the spring 84, the cam 82 is biased towards the right with respect to the sleeve 14 to a position which is limited by the retainer ring 80. With the parts thus related, it will be noted that the inclined operating surface 94 of the cam 82 permits sufficient radial movement of the balls to freely admit the end of the plug 12. The action of the spring 84 may be supplemented or replaced by utilizing magnetic principles. For example, the cam 82 and/or its retainer ring 78 may be permanently magnetized so that the cam will seek a position in contact with its retainer ring. Whereas it is contemplated that a spring or other resilient element may be used alone for this purpose or in combination with magnetic biasing, Fig. 6 of the drawings has been presented to illustrate the arrangement of parts where magnetic biasing alone is relied upon to serve this function.

With the parts in the positions depicted in Fig. 4 of the drawings, as the plug is advanced for introduction into the socket, the leading end of the plug will displace the balls 50 outwardly, since they are in released condition at this time, the shoulder 62 of the plug ultimately engaging the abutment 92 formed on the end of the sleeve 14, shifting the sleeve towards the right with respect to the socket member 16 and simultaneously compressing the spring 86 interposed between the shoulder of the socket member and its sleeve. Inasmuch as the balls have been projected outwardly by the end of the plug, the cam 82 will be restrained against movement with the sleeve and accordingly, its spring 84 will become further compressed so long as the positions of the balls produce an effective external diameter larger than that of the cylindrical portion of the cam intermediate the inclined operating surface 94 and the inclined operating surface 96. This condition has been depicted in Fig. 5 of the drawings, further movement of the plug towards the right bringing its recess 54 into registry with the balls, whereupon the camming action of the operating surface 94 of the cam under the influence of the spring 84 will drive the balls inwardly to seat in the recess 54 and simultaneously, the sealing surface at the leading edge of the plug will engage the packing 22 to effect a fluid tight seal. This assembled relationship of the parts is shown in Fig. 2 of the drawings.

When it is desired to uncouple the joint members, the sleeve 14 is shifted additionally towards the right to a position somewhat analogous to that depicted in Fig. 3 of the drawings, retracting the cam 62 from its confining position upon the balls while further compressing the spring 86 which governs the position of the sleeve with respect to the socket member. With the parts in the position depicted in Fig. 3, the plug 12 can be withdrawn, since the balls will ride up the inclined walls defining the recess 54 when the operating surface 96 of the cam has moved to the right of the balls as clearly shown in Fig. 3. Once the plug has been retracted from the socket by an amount sufficient to remove its recess 54 from registry with the balls, the latter will remain in their outer positions until the plug has been completely withdrawn. At this time, the cam will force the balls inwardly again as result of expansion of the spring 88 and the parts will return to the relative positions shown in Fig. 4 of the drawings.

Assuming that the socket member 18 is fastened to a wall bracket or even to a heavy hose line, the coupling operation can be effected by merely introducing the plug into the socket and advancing it until the balls are heard to snap into position. To uncouple the members, the sleeve is moved away from the plug, whereupon the thumb and forefinger of the operator engage the adjacent portion of the plug, following which movement of the plug and sleeve in the same direction will move the balls outwardly and the plug can then be readily retracted. Where the uncoupling operation is to be performed with the use of both hands, one will engage the plug and the other the sleeve, whereupon it is merely necessary to urge the two in opposite directions to remove the plug.

It will be noted that the parts of the socket member are entirely retained by the use of two split rings, representing a most simple and economical mode of assembly.

Whereas many modifications of the present invention will suggest themselves to those skilled in the art after becoming familiar with the present disclosure, and whereas such modifications are even now contemplated, it is believed that the examples depicted and described will suffice for illustration of the invention, the scope of which is not to be limited however, beyond that of the appended claims.

We claim:

1. A coupling comprising two joint members, a detent movably carried by one of said members for securing it to the other, said detent being in released condition prior to assembly of said members, detent operating means movably carried by one of said members for engagement with and in the path of the other and movable in one direction upon assembly of said members to operate said detent to its securing position, and said detent operating means being manually shiftable for imparting further movement to said detent operating means in the same direction to a detent releasing position.

2. A coupling comprising two joint members, a detent movably carried by one of said members for securing it to the other, said detent being in normally released condition, detent operating means movably carried by one of said members magnetically biased in one direction to shift said detent to its securing position and movable in another direction upon assembly of said members, and manually engageable means for imparting further movement to said detent operating means in the said one direction to a detent releasing position.

3. A coupling comprising two joint members, a detent movably carried by one of said members for securing it to the other, said detent being in released condition prior to assembly of said members, a detent operating cam movably carried by one of said members, a cam actuator carried by one of said members for engagement with and in the path of the other imparting movement to said cam in one direction upon assembly of said members to operate said detent to its securing position, and said detent operating means being manually shiftable for imparting further movement to said cam in the same direction to a detent releasing position.

4. A coupling comprising two joint members, detent balls movably carried by one of said members for securing it to the other, said balls being in normally released condition, ball operating means movably carried by one of said members

in the path of the other and movable in one direction upon assembly of said members to confine said balls to their securing positions, and manually engageable means for imparting further movement to said ball operating means in the same direction to a ball releasing position.

5. A coupling comprising two joint members, one of said members containing radial perforations, detent elements received in said perforations for securing said members in coupled relationship, said elements being in released condition, prior to assembly of said members, detent operating means movably carried by one of said members for engagement with and in the path of the other and movable in one direction upon assembly of said members to operate said elements to their securing positions, and said detent operating means being manually shiftable for imparting further movement to said detent operating means in the same direction to an element releasing position.

6. A coupling comprising two joint members, a detent movably carried by one of said members for securing it to the other, detent operating means movably carried by one of said members having a position for releasing said detent during assembly of said members, means carried by one of said members interposed in the path traversed by the other during assembly of said members to shift said operating means to a detent securing position during assembly of said members, and manually engageable means for imparting to said detent operating means a third position for releasing said detent.

7. A coupling comprising plug and socket members, a detent movably carried by said socket member for securing it to said plug, said detent being in released condition prior to assembly of said members, said plug containing a detent receiving recess, detent operating means movably carried by said socket member for engagement with and in the path of said plug and movable in one direction upon assembly of said members to position said detent in said recess, and said detent operating means being manually shiftable for imparting further movement thereto in the same direction to a detent releasing position.

8. A coupling comprising two joint members, a detent carried by one of said members in normally released condition, the other of said members containing a recess to receive said detent, a sleeve carried by said one member biased in one direction with respect thereto, a cam carried by said sleeve biased in another direction with respect thereto, means carried by said other member for shifting said sleeve during assembly of said members, such shifting of said sleeve increasing the bias on said cam to produce a snap action upon said detent when it registers with said recess, further shifting of said sleeve in the same direction releasing said detent.

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Sept. 12, 1950 C. E. EARLE ET AL 2,521,701

COUPLING

Filed Dec. 27, 1946

FIG. 1.

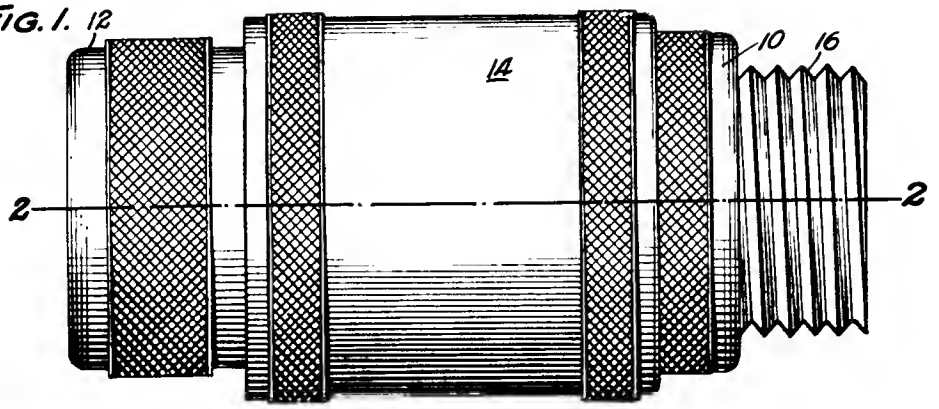


FIG. 2.

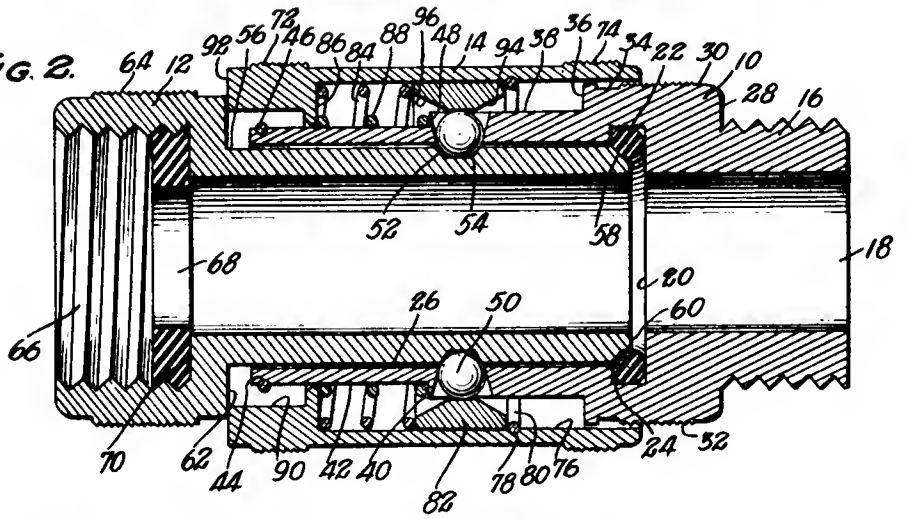
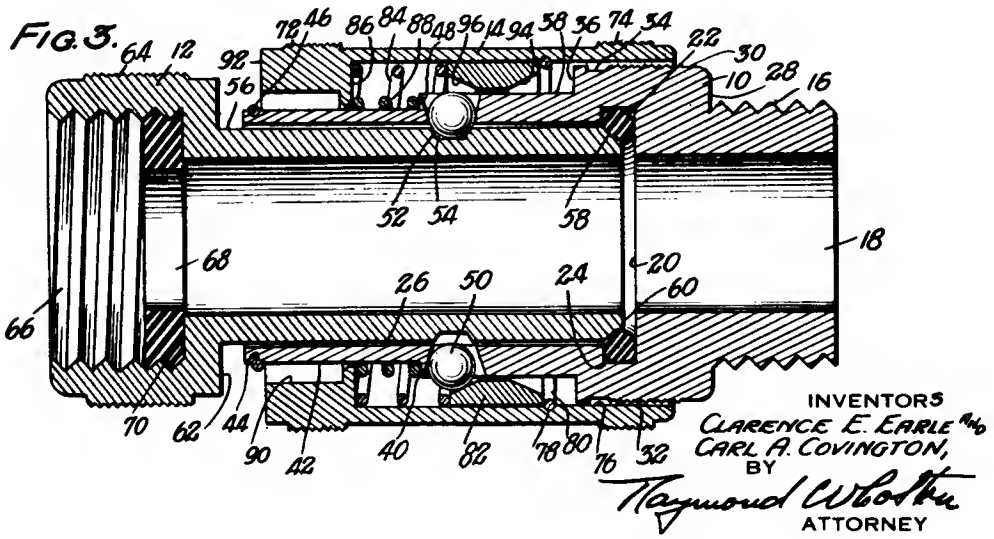


FIG. 3.



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Sept. 12, 1950 C. E. EARLE ET AL 2,521,701

COUPLING

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FIG. 4.

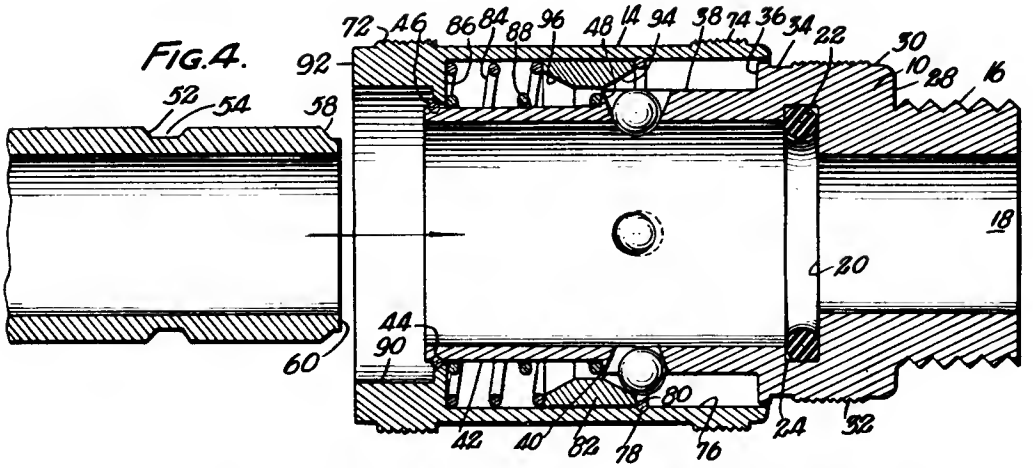


FIG. 5.

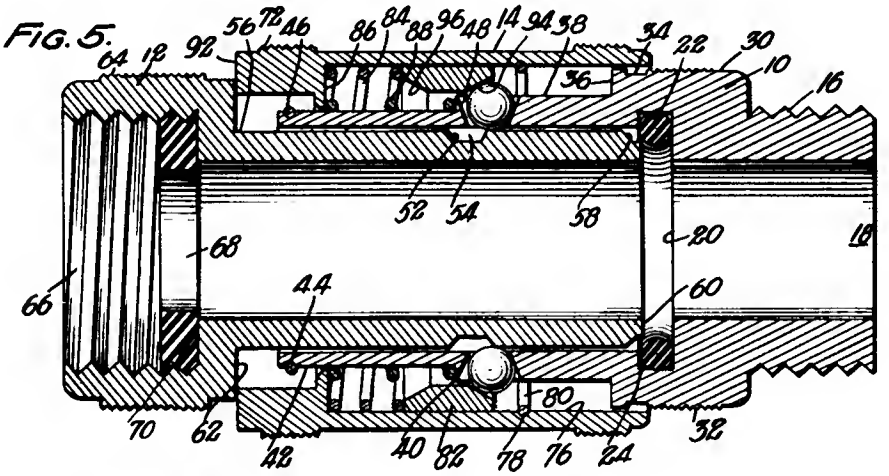
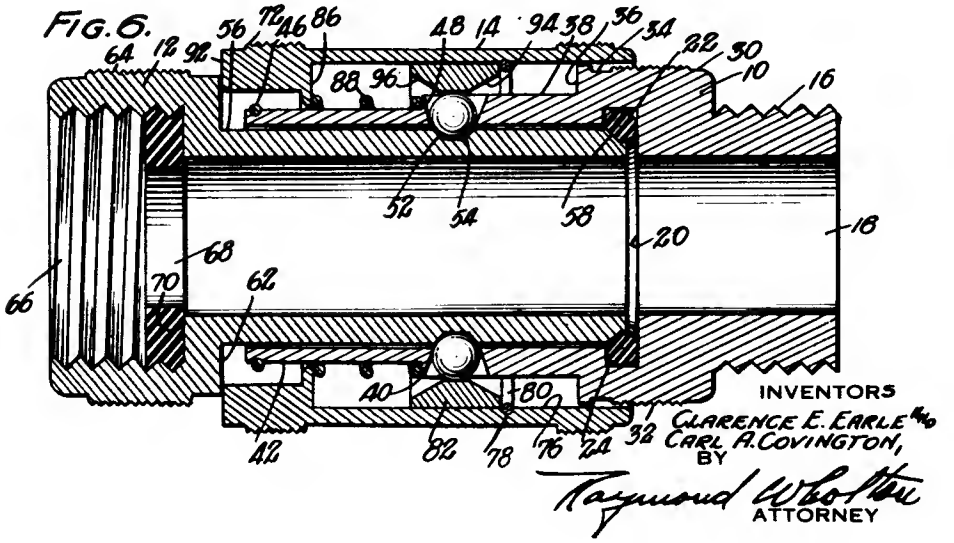


FIG. 6.



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Patented May 15, 1951 2,552,543

UNITED STATES PATENT OFFICE

2,552,543

COUPLING

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Application April 3, 1950, Serial No. 153,556

16 Claims. (Cl. 285—168)

1

This invention relates to couplings, and particularly to couplings which are quickly connected and disconnected, wherein a latching action is effected as the cooperating parts are relatively moved towards one another.

Whereas couplings of automatic and semi-automatic types have been proposed previously, the present invention presents marked improvements over the prior art structures from the standpoints of cost, simplicity, compactness, and strength, particularly in shear.

It is among the objects of this invention to provide a coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by the member, a detent operator housed within the member, a sleeve displacing element carried by the operator, and a plug member received in the socket and retained therein by the detent, the plug member providing an abutment engageable with the operator when the members are coupled to actuate the detent. The detent operator is preferably provided with means biasing it in one direction, and the plug member serves to overcome such biasing means and confine the detent when the members are coupled. A cam carried by the sleeve serves for engagement with the detent, the cam preferably assuming an annular form integral with the sleeve, and the detent being satisfactorily defined by a plurality of radially displaceable balls received in frusto-conical pockets penetrating the wall of the socket forming member.

The coupling is preferably provided with means biasing the operator towards a limiting position and the sleeve towards the detent, which may assume the form of a spring interposed between the member and operator on the one hand and a spring interposed between the sleeve and operator on the other. These springs may be concentrically arranged compression springs, which are arranged in separate chambers in order that there will be no possibility of the springs becoming interentangled. The plug member preferably provides a detent receiving recess to receive the detent upon registry therewith. Whereas in some instances, an intermediate portion of the plug may engage the operator, the leading end of the plug will appropriately provide the abutment. With the parts in coupled relationship, the sleeve is movable towards the plug member to release the detent and produce a tendency to eject the plug member from the socket member.

The detent actuating sleeve is preferably reciprocable with respect to the member, and the

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detent operator is likewise preferably reciprocable with respect to the member, and the sleeve displacing element may assume the form of a radially disposed pin projecting through the socket forming member into the path of the sleeve for engagement with the sleeve. The detent operator is not only housed within the socket forming member, but is preferably in a definitely spaced relationship with respect to the plug receiving end of the socket member.

The plug member preferably provides a skirt portion to receive and embrace the end of the socket forming member to sustain loads imposed by bending and shear.

A more complete understanding of the invention will follow from a detailed description of the accompanying drawings wherein:

Fig. 1 is a fragmentary elevation, partially in section, showing the members in coupled relationship;

Fig. 2 is a fragmentary sectional elevation depicting the members in separated relationship;

Fig. 3 is a fragmentary sectional elevation showing the coupling members in the relative positions which they assume at an intermediate phase of a coupling operation; and

Fig. 4 is a fragmentary sectional elevation depicting the relationship of the coupling members at a more advanced stage of a coupling operation than that shown in Fig. 3, just before the detent is advanced to its plug retaining position.

The socket member 10 containing a bore 12 provides a plug receiving end 14 for reception of a plug 16 containing a bore 18. The plug is provided with a skirt portion 15 defining an annular groove 17 to receive and embrace the end of the socket member 10 and sustain such shear and bending loads as may be imposed upon the coupling. Near the plug receiving end of the socket member, but spaced therefrom, a plurality of radially divergent pockets 20 are formed through the wall of the socket member to receive a corresponding number of detent balls 22. These balls are of such diameter that they will not pass inwardly through the socket member when the plug has been withdrawn, as depicted in Fig. 2. Spaced from the ball receiving pockets, the socket forming member is provided with a plurality of slots 24 penetrating its wall for penetration of a similar number of pins or sleeve displacing elements 26, carried by a detent operator 28 which is reciprocable in a reduced bore 30 formed within the socket member. The detent operator 28 is

biased towards the plug receiving end of the socket member by means of a compression spring 32 interposed between a shoulder 34 of the socket member and the proximate wall of the detent operator.

Surrounding the socket forming member 10 and reciprocable thereon, is a detent actuating sleeve 36 providing a cam surface 38 for confining the detent balls, a shoulder 40, Fig. 4, serving as an abutment for the sleeve displacing element or pin 26, and a counter bore 42 which receives a spring 44 interposed between a ring 46 bearing against the end of the pin or pins 26 and a ring 48 held within the counter bore by means of a split retaining ring 50.

The plug member 16 provides a reduced leading end 52, and an intermediate annular groove or recess 54 defined by a bottom wall 56 and inclined side walls 58 and 60. It is this groove or recess which receives the detent or detents when the members are coupled to retain them in assembled relationship.

With the parts of the coupling in the positions depicted in Fig. 2, which positions would exist prior to a coupling operation, the plug member 16 will be introduced into the plug receiving end 14 of the socket member 10 until the reduced end or nose 52 of the plug moves the balls 22 outwardly as shown in Fig. 3, further advancement of the plug causing the balls to assume the position depicted in Fig. 4, restraining the sleeve 36 against movement to the left. As viewed in Fig. 3, the leading end of the plug member is approaching the proximate end of the detent operator 28, which it ultimately engages, and as viewed in Fig. 4, the detent operator is shifted towards the left against the force of its compression spring 32, thereby moving the sleeve displacing elements or pins 26 towards the left against the ring 46 to compress the spring 44, whose opposite end bears upon the ring 48, biasing the sleeve 36 towards the left, as depicted in Fig. 4. Then, as the plug member is advanced to an even greater extent than that depicted in Fig. 4, the groove or recess 54 registers with the balls 22, which are then forced inwardly by the cam surface 38 of the sleeve 36 as the sleeve now moves to the left, being no longer restrained by the balls which had been imposed in its path. Thus, the parts will assume positions such as those depicted in Fig. 1, representing a coupled relationship of the cooperating members.

When the members are to be disengaged, the sleeve 36 will be shifted from the position shown in Fig. 1, towards the right, or in other words, towards the plug member, until the bore 39, adjacent the cam surface, registers with the balls. This movement of the sleeve towards the right compresses the spring 44 which imposes a force upon the pins 26, tending to move the detent operator towards the right also, which movement is restrained, of course, as long as the plug is in its coupled position. As soon as the bore 39 registers with the balls however, and permits the balls to move outwardly, under the effect of the cam defined by the inclined surface 58 carried by the plug member, the combined effects of the springs 44 and 32 will tend to eject the plug member from the socket member.

Whereas no seals have been shown, it will be recognized by those skilled in the art that where the coupling is to be used for conducting fluids, seals can be introduced between any relatively movable parts where leakage might occur. Where the coupling is used for purposes other than the conduction of fluids, seals will ordinarily not be required.

Whereas the inventors have elected to show but one operative form of coupling for purposes of illustration, the invention should not be restricted to this particular form beyond the scope of the appended claims.

We claim:

1. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

2. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, means biasing said operator in one direction, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator to overcome said biasing means and advance said detent when said members are coupled.

3. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a cam carried by said sleeve for engagement with said detent, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

4. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, an annular cam integral with said sleeve for engagement with said detent, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

5. A coupling comprising a socket forming member, a plurality of radially displaceable balls constituting a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

6. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, means biasing said operator towards a limiting position and said sleeve towards said detent, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

7. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, a spring interposed be-

tween said member and operator, a spring interposed between said sleeve and operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

8. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, concentric compression springs interposed between said operator and said member and sleeve respectively, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

9. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member having a detent receiving recess received in said socket and retained therein by said detent, said plug member having a leading end providing an abutment engageable with said operator when said members are coupled to actuate said detent.

10. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent, said sleeve being movable towards said plug member to release said detent and eject said plug member from said socket member.

11. A snap coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, a spring interposed between said operator and sleeve, and a plug member received in said socket and retained therein by said detent, said plug member having a detent receiving recess and providing an abutment engageable with said operator to compress said spring until said detent and recess register when said members are coupled.

12. A coupling comprising a socket forming member having a plug receiving end, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member in spaced relationship with respect to said end, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

13. A coupling comprising a socket forming member, a detent and a reciprocable detent actuating sleeve carried by said member, a reciprocable detent operator housed within said member, a radially disposed sleeve displacing pin carried by said operator and projecting into the path of said sleeve, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent through said pin.

14. A coupling comprising a socket forming member having a plug receiving end, a plurality of detent balls and a detent actuating sleeve carried by said member, a detent operator housed within said member, a spring biasing said operator towards said end, a sleeve displacing element carried by said operator and projecting radially through said member for engagement with said sleeve, and a plug member received in said socket and retained therein by said detent, said plug member providing an abutment engageable with said operator when said members are coupled to actuate said detent.

15. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing a portion embracing said socket forming member and an abutment engageable with said operator when said members are coupled to actuate said detent.

16. A coupling comprising a socket forming member, a detent and a detent actuating sleeve carried by said member, a detent operator housed within said member, a sleeve displacing element carried by said operator, and a plug member received in said socket and retained therein by said detent, said plug member providing a skirt for reception of said socket forming member and providing an abutment engageable with said operator when said members are coupled to actuate said detent.

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No references cited.

May 15, 1951 C. E. EARLE ET AL 2,552,543

COUPLING

Filed April 3, 1950

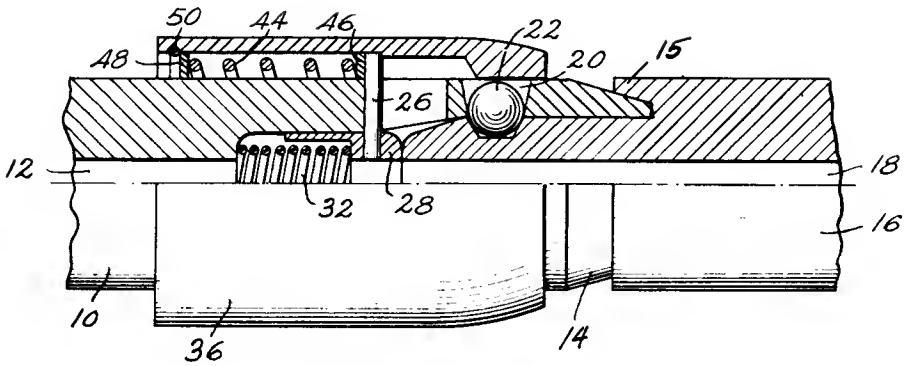

Fig. 1

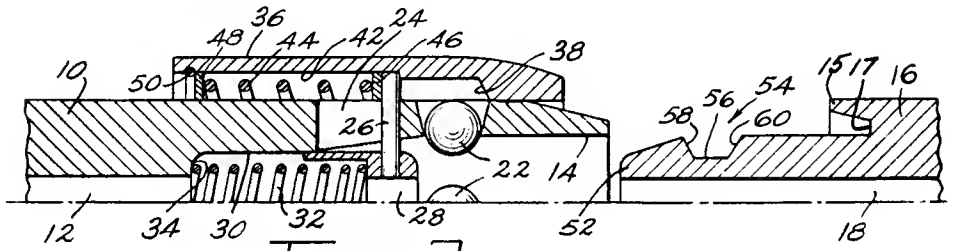

Fig. 2

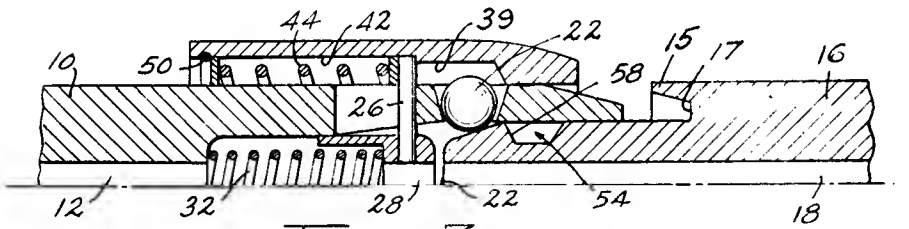

Fig. 3

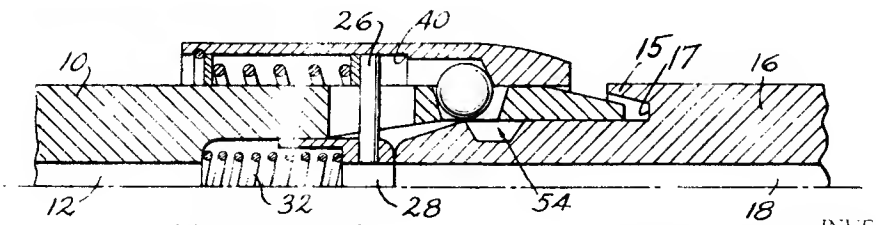

Fig. 4

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Patented Apr. 6, 1954 2,674,469

UNITED STATES PATENT OFFICE

2,674,469

FLUID COUPLING

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Application July 30, 1948, Serial No. 41,538

11 Claims. (Cl. 284—18)

1

This invention relates to couplings of the plug and socket type, and particularly to fluid couplings of this type.

There are many installations requiring couplings which can be separated manually and which will become disconnected automatically and without breakage in response to excessive tension on the line including the coupling and/or fluid pressure within the coupling itself. There is also a need for a coupling one or both of whose members will be automatically closed upon separation of the coupling and automatically opened for fluid flow upon coupling of its members.

These various requirements have been satisfied according to the present invention by the provision of a coupling comprising plug and socket members having interfitting double end walls, a detent carried by the walls of one of the members for engagement with the other of the members, the walls of the other of the members being relatively movable axially for selectively projecting and releasing the detent. The relatively movable walls are preferably provided with means for limiting their relative movement in both directions. The relatively movable walls are preferably biased towards a detent projecting position by means of a spring interposed between them. One of these walls may provide an annular groove for reception of the detent, at least one of the surfaces defining the groove being radially inclined to define a cam surface for cooperation with the detent. The detent may comprise one or more, preferably more, pocketed balls which can be projected through the inner wall of the one member by the relatively movable wall of the other member into the groove formed in the relatively fixed wall of the other member.

Fluid couplings contemplated by the present invention are preferably provided with sealing gaskets carried by one of the members for engagement with the other. A valve may be carried by one of the members and an actuator therefor by the other. Interacting valves may be carried by both members, the opening and closing of which may be accomplished automatically upon the coupling and uncoupling movements respectively, or the actuation may be accomplished manually. The member provided with the relatively movable wall may be connected with an element slidable with respect thereto to release the detent in response to a predetermined movement of the element. This predetermined movement may be that resulting

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from separation of the coupling members, which members may be biased to restrain them against separation by means of a spring. Release of the detent may be achieved by means responsive to a predetermined fluid pressure for shifting the movable wall, a predetermined tension on the coupling or jointly by either or both of these effects. The movable wall will in most cases provide gripping surfaces for manual separation of the coupling members. In the various forms depicted for illustration herein, the coupling operation involves a snap action since the detent restrains movement of the relatively movable wall of one of the members until the groove in its other wall registers with the detent, whereupon the relatively movable wall forces the detent into the groove with a snap action under the influence of a biasing spring which has become compressed during the relative movement of the walls.

A more complete understanding of the present invention will follow from a detailed description of the attached drawings wherein:

Fig. 1 is a sectional elevation, partially broken away, depicting the coupling with its members interengaged;

Fig. 2 is a sectional elevation, partially broken away depicting the coupling of Fig. 1 as its members are being separated;

Fig. 3 is a sectional elevation, partially broken away, depicting the coupling of Fig. 1 with its members separated to a greater degree;

Fig. 4 is a sectional elevation, partially broken away, showing the coupling of Fig. 1 with the members being moved towards their coupled relationship;

Fig. 5 is a sectional elevation, partially broken away, of a coupling which automatically separates in response to excessive internal pressure or tension;

Fig. 6 is a sectional elevation, partially broken away, of a modified form of coupling;

Fig. 7 is a sectional elevation of another type of coupling embodying the invention;

Fig. 8 is a sectional elevation partially broken away of a further modification; and

Fig. 9 is a section taken along line 9—9 of Fig. 8.

The socket member 20, as shown in Figs. 1 to 4 is provided with a reduced end 22 defining an inner wall and with an intermediate reduced threaded portion 24 for reception of an internally threaded sleeve 26 defining an outer wall. The inner wall 22 is perforated at desired intervals around its periphery to define pockets 28 which

converge inwardly to receive and retain detent balls 30. The socket member is provided with an internal groove 32 for the reception of a resilient sealing member 34 which may be of the O-ring type, a toroidal rubber like body. A plug member 36 is provided with a leading end 38 for engagement with the sealing member and defining an inner wall. A sleeve 40 carried by the plug member constitutes a relatively movable outer wall whose leading end 42 is received in the groove defined between the inner and outer walls of the socket member. The relatively movable outer wall 40 is formed with an intermediate flange 44 providing a bearing surface for a spring 46 interposed between it and a flange 48 formed externally on the inner wall of the plug member. A retainer ring 50 is seated in a groove formed internally of the relatively movable wall to limit its forward movement under the influence of the spring with respect to the inner wall. The inner wall receives an external annular groove 52 having an inclined surface 54 which serves as a cam to release the detent element during a separating movement of the coupling members.

Fig. 2 shows the relative positions of the parts as they are being separated by movement, in the direction of the arrow, of the sleeve or relatively movable outer wall 40 which has just begun to uncover the detent ball 30 against the force of the spring 46. As soon as the outer wall 40 has been moved far enough in the direction of the arrow to release the detent balls 30, the force transmitted to the inner wall 38 through the spring will urge the balls outwardly due to the camming effect of the surface 54 and the parts will assume relative positions corresponding to those depicted in Fig. 3 from which positions they can be entirely separated. When it is desired to couple the members, they will be pushed together through a position corresponding to that shown in Fig. 4 until the leading edge 42 of the outer wall 40 engages the detent 30, further forward movement of the plug 36 compressing the spring 46 until the groove 52 registers with the detent, whereupon the force transmitted from the spring through the sleeve or relatively movable wall 40 will project the detent into the groove with a snap action returning the parts to the relative positions shown in Fig. 1.

Insofar as applicable, the reference characters discussed with reference to Figs. 1 to 4 have been carried over in describing the corresponding portions of the other figures. In Fig. 5, the plug member 36 comprises additional parts, the groove 52 for receiving the detent being formed in the surface of a sleeve 56 biased towards its normal position shown by means of a spring 58 of predetermined strength interposed between an inturned flange 60 formed on the sleeve and a washer 62 positioned by a retainer 64 seated in a groove formed in the plug member. The spring 58 urges the sleeve 56 into abutment with a sleeve 66 having a radial flange 67 which serves as a limiting stop for the relatively movable outer wall 40 by engagement with the retainer ring 50 thereof. A retainer ring 69 secures the sleeve 66 against movement on the plug 36 where automatic separation of the coupling is desired in response to excessive fluid pressure or mechanical tension. By omitting the ring 69, the coupling will not separate automatically but will absorb vibrations that might otherwise cause damage to the balls 30.

The plug and socket members are provided with interengaging valves 68 and 70 having seats 72 and 74 towards which they are biased by springs 76 and 78, all respectively. With the parts in the positions depicted in Fig. 5, it will be clear that the coupling can be separated by manually shifting the movable outer wall 40 towards the left against the force of the spring 46 until the detent 30 is released, in a manner similar to that described with reference to Figs. 1 to 4 inclusive. Where the internal pressure of the fluid passing through the coupling exceeds a predetermined value, it exerts a force to separate and uncouple the plug and socket members automatically. Assuming that the plug member 36 is stationary, the socket member 20 will tend to move towards the right, carrying with it the sleeve 56 interlocked therewith by the detent 30 and compressing the spring 58 against the stop defined by the washer 62 and retainer ring 64. Depending upon the fluid pressure and calibration of the spring 58, this movement will continue until the forward edge 42 of the movable wall or sleeve 40 uncovers the detent 30, whereupon the camming action of the surface of the groove 52 forces the detent radially outwardly and the members can be separated. A similar action is experienced when tension is applied to the ends of the members 20 and 36, as would be occasioned, for example, where the coupling is used between a tractor and trailer. In such a case, where the draw bar connection should fail or be disconnected, it will be clear that the fluid coupling will separate automatically without breakage of its components or external connections, and at the same time, the internal valves 68 and 70 will prevent the loss of any appreciable fluid. Upon reassembling such a coupling, the internal valves will engage one another at their abutting surface 82 and reopen automatically as the coupling operation progresses, to assume once more the positions depicted in Fig. 5.

The modified form of the coupling appearing in Fig. 6 provides automatic release when tension on the members, or in the line containing the members, exceeds a predetermined value. As in the previous cases, manual separation is likewise possible. The socket member 20 again provides a reduced end 22 defining an inner wall and a counterbored sleeve 26 defining an outer wall, these parts being suitably secured together as by screw threads 80 as shown. An internal groove 32 formed in the inner wall of the socket member, serves to receive a sealing member 34 and a suitable number of pockets 28 receive a corresponding number of detent balls 30. The socket member is provided with an internal valve 70 cooperating with a seat 74 towards which it is biased by a spring 78 interposed between the valve and a fixed portion of the socket member. In the assembled condition shown, the valve 70 has a surface 82 which abuts a similar surface of the cooperating valve 68 which engages a seat 72 under the influence of a spring 76 biasing the valve to such a position as the members are separated. The leading end 38 of the plug member 36 contains a groove 52 for registry with the detent ball or balls 30 when the members are assembled. This leading end or inner wall defining member is suitably secured by means of threads 84 to a body member 86 which partakes of telescopic movement with respect to a terminal member 88 in which it is slidably received. The terminal member has a threaded end 90 which may be secured to a suitable support or in a fluid line, the opposite end of the terminal member containing a counterbore 92 defining a skirt 94 con-

taining a radial slot 98 through which a nipple 88 is threaded into a transverse bore 100 of the body member 88. A flexible tube 102 secured to the outer end of the nipple 98 by means of a suitable clamp 104, extends to a similar nipple 106 threaded into a transverse bore 108 formed in the terminal member 88, the tube being secured to the second nipple by means of a similar clamp 104. The forward end of the terminal member is provided with an out-turned flange 110 which is received within a counterbore 112 formed in the member 40 defining the outer wall of the plug member, these parts being connected by means of a retainer ring 50. Where it is desired to separate the parts manually, the relatively movable outer wall or sleeve 40 of the plug member can be retracted from the socket member against the force of the calibrated spring 58 until the ball or balls are released for outward radial movement by the camming surface of the groove 52, whereupon the members can be entirely separated their valves closing automatically during the separating operation. When the members are subjected to tension, assuming the socket member 20 to remain stationary, the terminal member 88 will move to the left, transmitting this motion through the retainer ring 50 to the movable outer wall, or sleeve 40 against the force of the spring 58. When the tension is of sufficient value to retract the leading end of the sleeve 40 to a position uncovering the balls, the entire plug assembly will be withdrawn from the socket assembly as occurred in the manual operation. The flexibility of the tube 102 readily permits the degree of movement between the body and terminal members 86 and 88 permitted by the length of the slot 96. Thus here again, when the coupling is subject to excessive tension, the members will separate without breakage and their internal valves will close automatically without any appreciable loss of fluid.

Fig. 7 depicts an application of the coupling of the present invention to the under-wing filling of aircraft fuel tanks. In this application, the socket member 20 is secured by bolts 112 to a flange 114 carried by the fuel tank or similar apparatus. A spider 116 is interposed between the flange and socket member to serve as a guide for the stem 118 of a valve 120 biased by means of a spring 122 towards its resilient seat 34 which also serves as the sealing member for the leading end of the plug member 36. The plug member contains a valve 124 having a seat 126 formed in the leading end of the plug member, a stem 128 for actuating this valve extending through an opening 130 provided in a curved portion of the wall of the plug member, the opening being counterbored to receive a toroidal rubber-like packing 132 sufficiently deformed to provide a seal by means of a gland nut 134. The valve stem 128 terminates in a threaded end 138 which receives an internally threaded hand wheel 138 for advancing or retracting the valve 124. A pin 140 secured in a projecting portion of the gland nut 134 cooperates with a slot 142 in the valve stem to permit axial movement thereof and at the same time prevent rotation. The hand wheel receives antifriction bearings 144 positioned by an annulus 146 and a retainer ring 148. The trailing end of the plug member is provided with threads 150 for connection with a suitable supply line. The coupling and uncoupling operations are effected precisely as described with reference to Figs. 1 to 4 inclusive, and in addition, by operation of the hand wheel 138, the valves 120 and 124 can be opened after the coupling has been made and closed before it is broken to avoid the escape of any liquid, which in the case of high test gasoline, might well be quite important. As will be noted from Fig. 7, the valve 120 is provided with a guide pin 152 for registry with a complementary socket in the end of the valve 124 to assure proper registry.

Figs. 8 and 9 depict a further modification of the invention having functions similar to those described with reference to Fig. 6. The socket member 20 and its components are substantially the same as the corresponding parts described with reference to Fig. 6. The plug member 38 comprises the inner wall 38 providing the annular detent receiving groove 52 surrounded by the relatively movable wall or sleeve 40 biased forwardly by means of the spring 58 received in its counterbore 154. In this case, the internally threaded wall 38 receives the threaded end of a body member 156 communicating through its radial passage 158 and axial passages 160 with transverse passages 162 formed in a relatively telescopic terminal member 164. This terminal member provides an external flange 166 received internally by the sleeve 40 and retained therein by the retainer ring 50. The telescopic body and terminal members 156 and 164 contain grooves 168 for the reception of toroidal rubber or rubber-like O-rings 170. The aggregate area of the axial passages 160 is approximately the same as the area of the bores of the coupling members themselves so that there will be no substantial resistance imposed to the flow of fluid through the line. In order that no fluid will be entrapped between the telescopic body and terminal members, the space 172 defined between them is provided with a radial vent 174 to atmosphere.

As in the preceding modifications, manual separation will be effected by retracting the relatively movable sleeve or outer wall 40 to the left until its end uncovers the balls 30, whereupon the balls will be urged outwardly from the groove 52 and the parts can be separated. Where the coupling members are subjected to tension, assuming the socket assembly 20 to be fixed, the terminal member 164 will move towards the left engaging the retainer ring 50 and transmitting the motion to the sleeve 40 against the force of the spring 58 until the balls 30 are uncovered sufficiently to move beyond the annular groove 52, whereupon the assembly will be separated as before. The valves 68 and 70 will function in a manner similar to that described with reference to Figs. 5 and 6, thus assuring that no appreciable quantities of fluid will be lost during coupling and uncoupling operations.

Although several forms of the invention have been described by way of illustration, many more applications will suggest themselves to those skilled in the art, just as such applications have occurred already to the present inventors. Accordingly, the scope of the invention should not be restricted to the illustrations presented, beyond the scope of the appended claims.

We claim:

1. An automatic coupling comprising plug and socket members, relatively movable spaced axial walls carried by one of said members, a biasing spring relatively positioning said walls, a wall provided by the other of said members carrying a radially shiftable detent projecting therebeyond into the path of at east one of said axial walls, one of said axial walls containing a detent receiving annular groove and having a portion

engaging said detent during a coupling operation to shift said detent into the path of the other of said axial walls and restrain movement thereof until said detent and groove achieve registry, said other axial wall having a detent actuating portion normally positioned axially intermediate said groove and detent engaging portion and a substantially cylindrical detent retaining surface overlying said detent when said members are coupled, whereupon said other of the axial walls is shifted by said spring to retain said detent in said groove upon registry of said detent and groove.

2. An automatic coupling as set forth in claim 1 wherein said groove and detent carrying wall have a combined radial dimension exceeding that of said detent.

3. An automatic coupling as set forth in claim 1 wherein said detent is a ball.

4. An automatic coupling as set forth in claim 1 wherein said spring is disposed between said relatively movable walls.

5. An automatic coupling as set forth in claim 1 wherein said annular groove includes a cam surface engageable with said detent to move it radially during separation of said members.

6. An automatic coupling as set forth in claim 1 wherein a fluid seal is carried by one of said members for engagement with the other of said members when they are coupled.

7. An automatic coupling as set forth in claim 1 wherein a valve is carried by one of said members and an actuator is carried by the other of said members for actuating said valve during a coupling operation.

8. An automatic coupling as set forth in claim 1 wherein an element is slidably connected with said other axial wall to release said detent in response to a predetermined movement.

9. An automatic coupling as set forth in claim 1 wherein said other of said members is provided with a second wall overlying said detent for reception of the detent actuating portion of said other axial wall.

10. An automatic coupling as set forth in claim 1 wherein an element is slidably connected with said other axial wall to release said detent in response to a predetermined movement, and said biasing spring urges said element in opposition to said movement.

11. An automatic coupling as set forth in claim 1 wherein means responsive to a predetermined fluid pressure is connected with one of said relatively movable walls under coupled conditions to effect relative movement thereof to release said detent.

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April 6, 1954 C. E. EARLE ET AL 2,674,469

FLUID COUPLING

Filed July 30, 1948

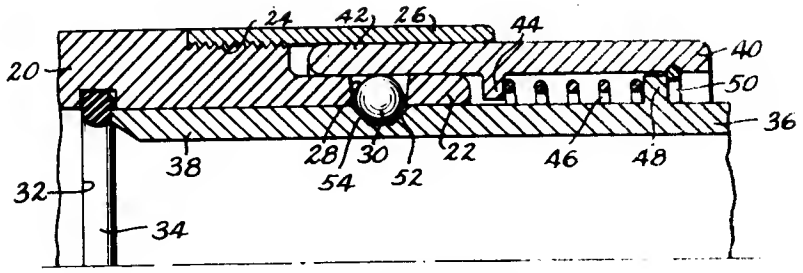

FIG. 1

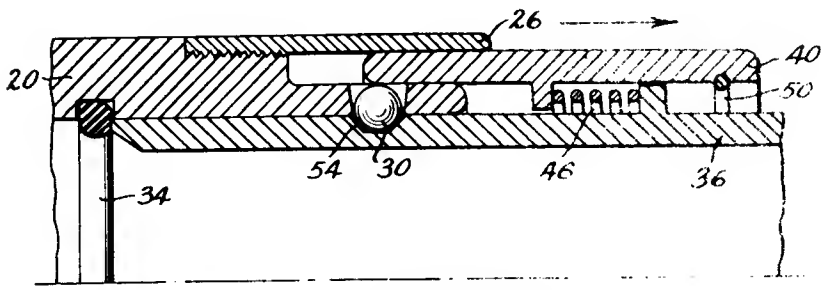

FIG. 2

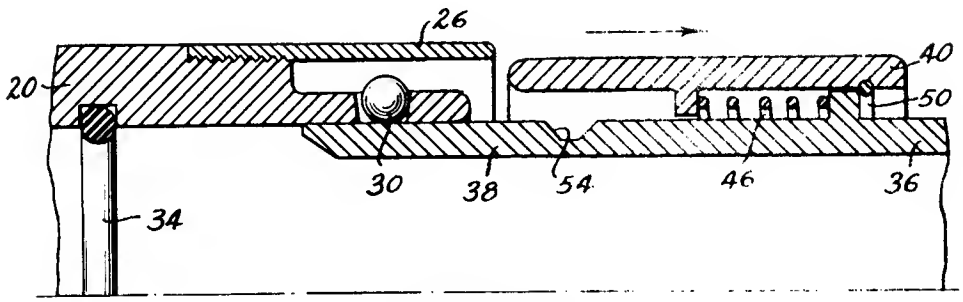

FIG. 3

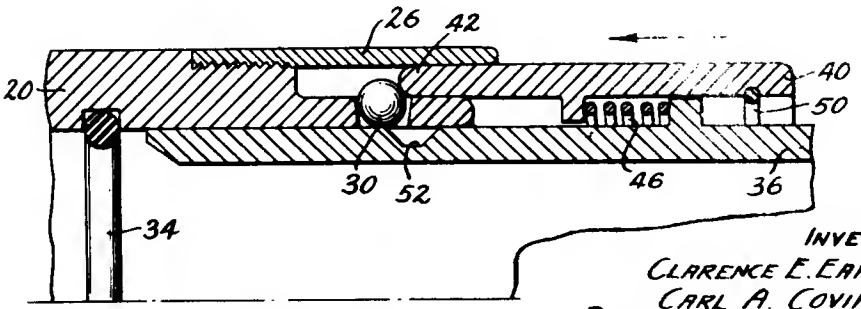

FIG. 4

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April 6, 1954 C. E. EARLE ET AL 2,674,469

FLUID COUPLING

Filed July 30, 1948

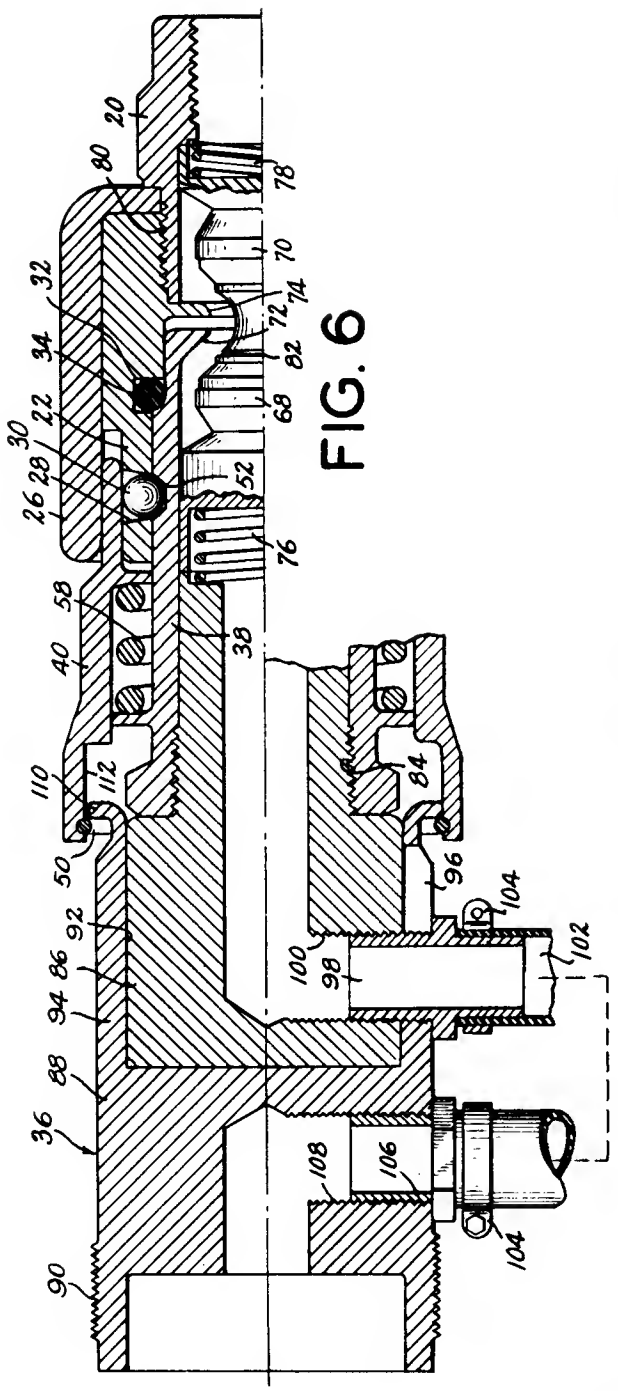

FIG. 6

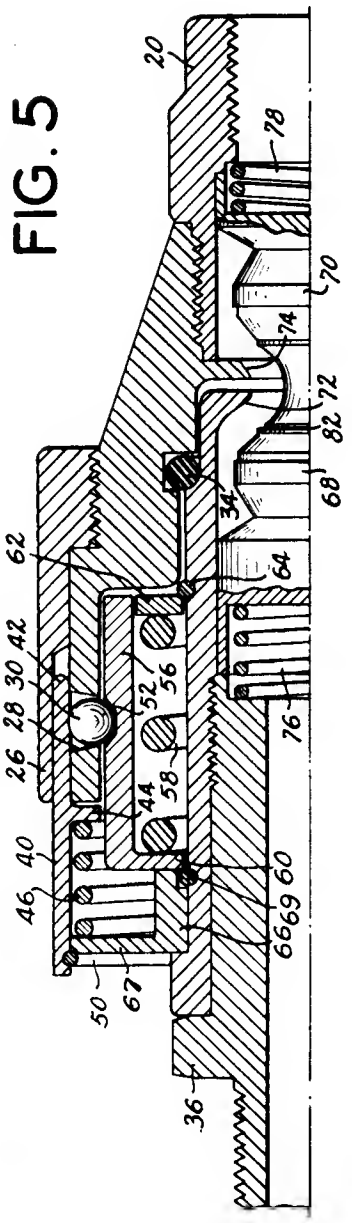

FIG. 5

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April 6, 1954 C. E. EARLE ET AL 2,674,469

FLUID COUPLING

Filed July 30, 1948

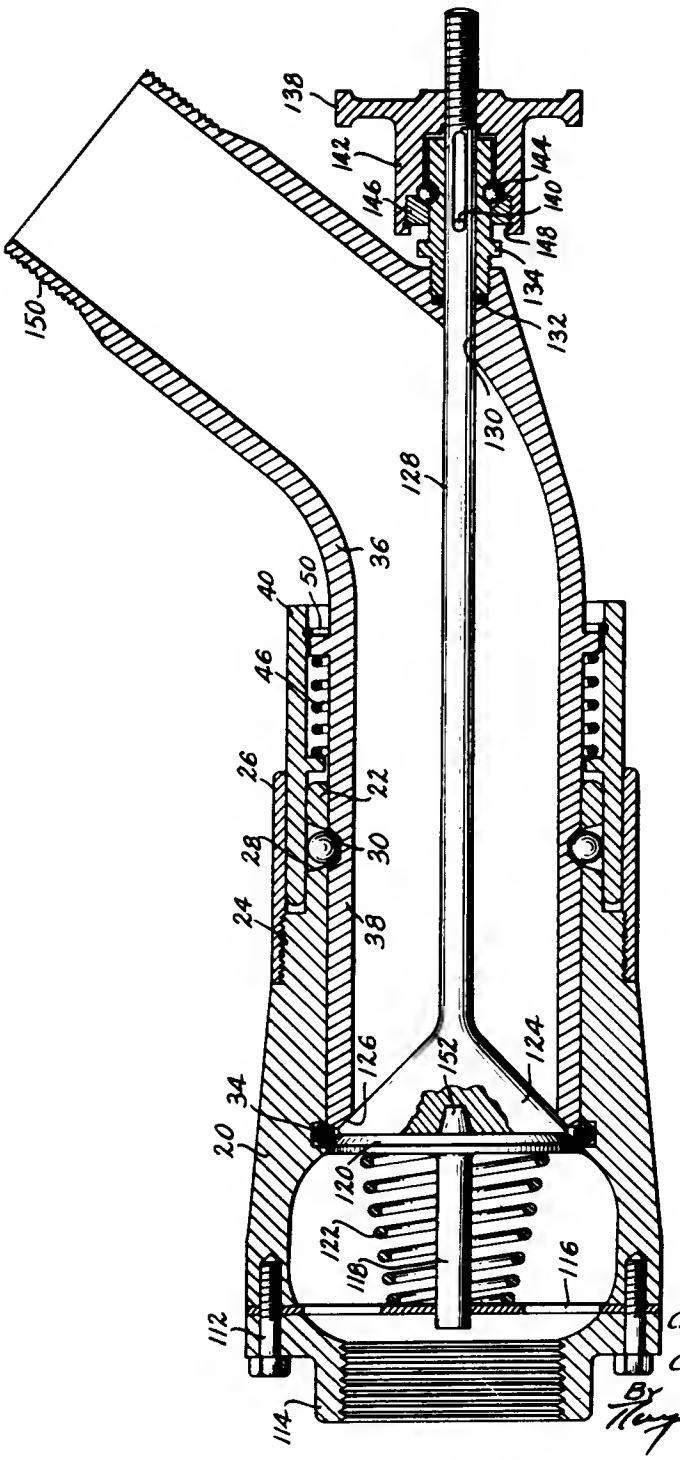

FIG. 7

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April 6, 1954 C. E. EARLE ET AL 2,674,469

FLUID COUPLING

Filed July 30, 1948

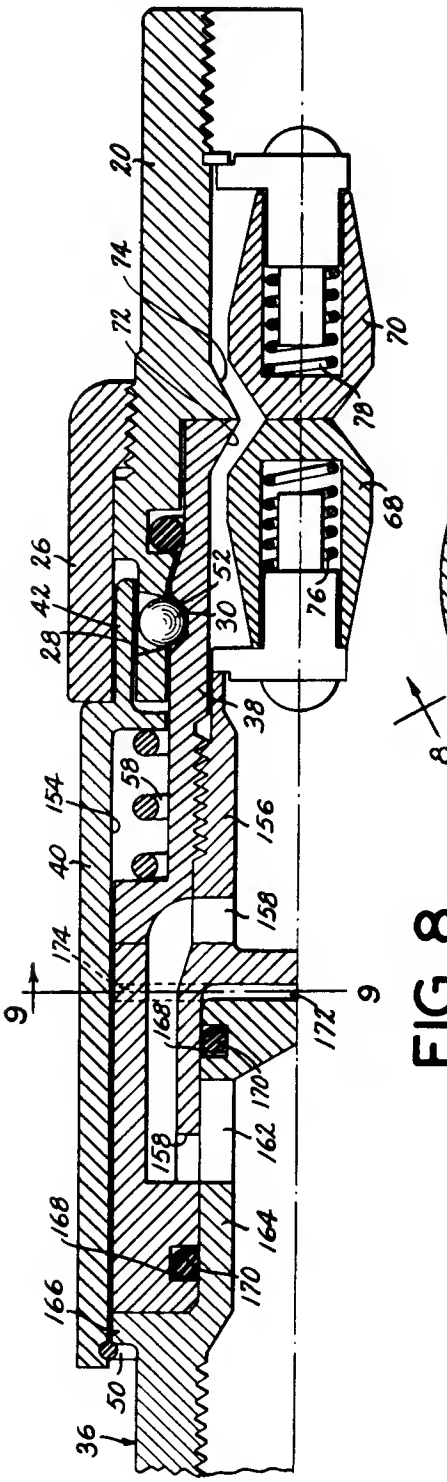

FIG. 8

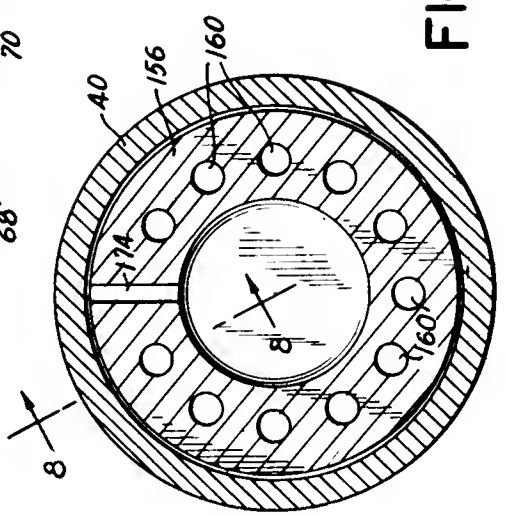

FIG. 9

INVENTOR
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CARL A. COVINGTON,
BY Raymond Wootton
ATTORNEY

Other types of quick disconnect couplings

1. BRECO Pushomatic Couplings - Extracted from Catalog of Perfecting Service Company, 332 Atando Ave., Charlotte 6, N.C.

2. Quick Disconnect and Self Sealing Couplings for Fluid Applications pp. J12 and J13, Product Engineering, Mid October 1956.

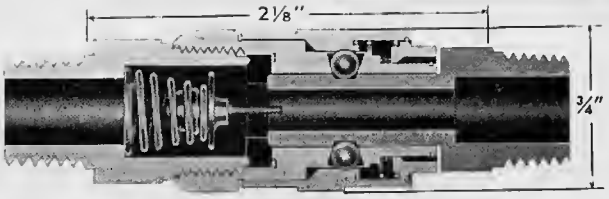
3. Snap Tite Ad, Product Engineering, pp. J20.

4. Foster Mfg. Co. Ad.

ENGINEERING DATA

SERIES 2A

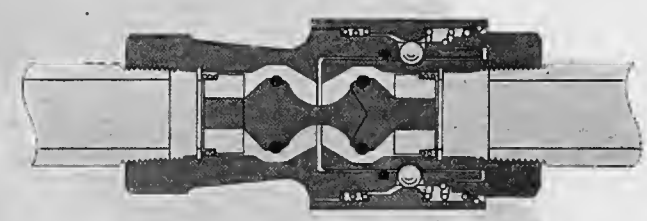
Maximum Working Pressure—10,000 PSI
Flow—See chart below
Pressure Drop—4 PSI at 15 CFM and 100 PSI
Dimensions—See photo at right
Material—SOCKET —Brass
PLUG —Steel
SEAL —For most fluids and gases. Special seals can be furnished for unusual application.
SPRINGS —Stainless Steel
BALLS —Stainless Steel
CLIPS —Stainless Steel



PATENTED

PATENTED

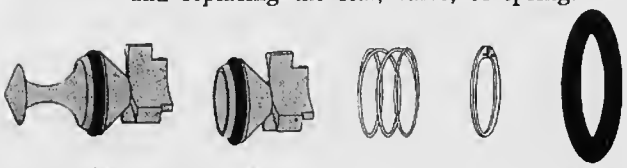
Photograph shows rugged, compact design. Swivel action prevents twisting and kinking of hose lines.



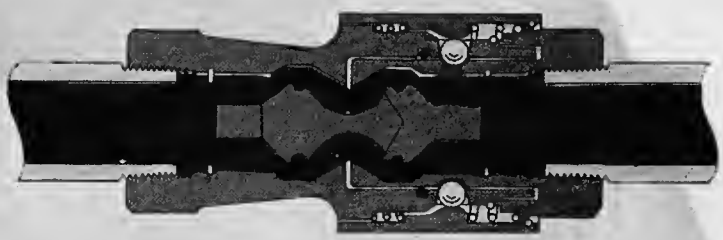
Cross section shows detailed construction and locking operation. Note simplicity and minimum of working parts.

RENEWAL PARTS

Breco Couplings may be easily repaired after eventual wear by removing inside retainer clip and replacing the seal, valve, or spring.

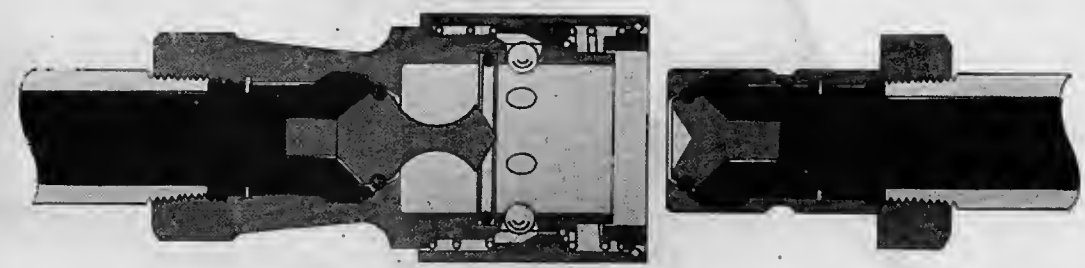


Socket Valve | Plug Valve | Spring | Clip | Body "O" Ring



Material flow area is shown here, with minimum restriction. Check valves open automatically and balance flow area when engaged.

Size	Socket Valve with Seal	Plug Valve with Seal	Spring	Clip	Body O-Ring
¼	2G03-C	G203-C	2G08-C	043ARI-TP	C092M-OP
⅜	3G03-C	G303-C	3G08-C	056ARI-TP	C096M-OP
½	4G03-C	G403-C	4G08-C	068ARI-TP	C097M-OP
¾	6G03-C	G603-C	6G08-C	090ARI-TP	C102M-OP



This cross section shows check valves closed against pressure when socket and plug are disconnected. No leakage as line pressure works with check valves.

BRECO PUSHOMATIC PATENTED ACTION

Quick Disconnect and Self-Sealing

Many fluid lines require frequent assembly and disassembly. On disassembly, sealing is also necessary to keep hydraulic oil and pneumatic installations free of foreign

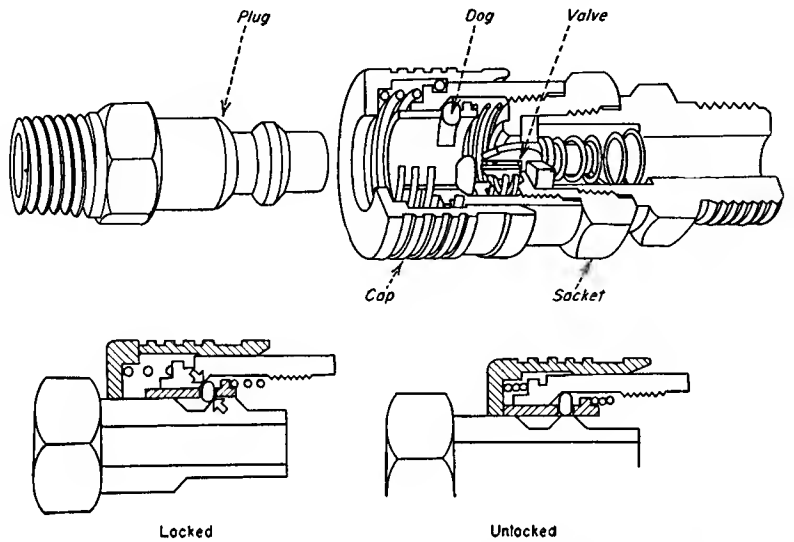


FIG. 1—Air coupler that is full swiveling. Inserting plug into socket forces valve away from seat making connection. Dogs lock against plug and socket grooves at a 45 deg angle. (Note arrows in locked view.) To uncouple, cap is pulled back on socket and plug pops out allowing valve to reseat shutting off air. Socket must be connected to air source. *Foster Mfg. Co., Inc.*

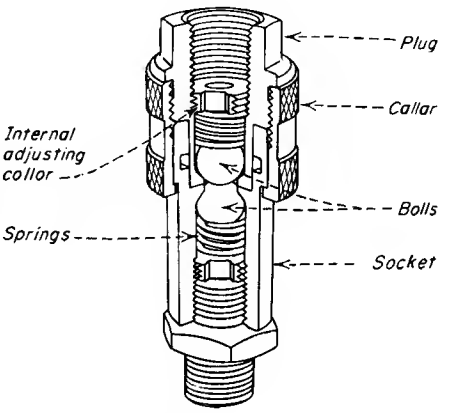


FIG. 2—High pressure hydraulic coupler. Threaded collar pulls the socket and plug together forcing the steel balls off their seats. On disconnecting, spring force reseats the balls. Internal collar permits increasing or decreasing of the spring force to perfectly center the ball checks. Unit is recommended for pressures up to 10,000 psi; flow up to five gallons per min. *Pioneer Hydraulics, Inc.*

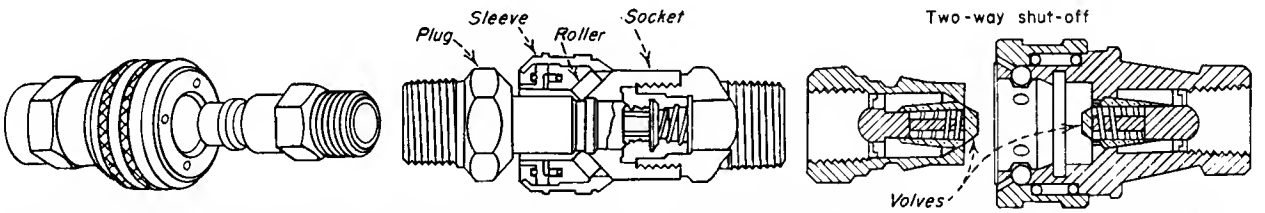


FIG. 3—Two-way shut off fluid line coupler. To connect, the plug is pushed into the socket forcing valves apart and off their seats. Rollers maintain plug in socket. To disconnect, sleeve on socket is pushed back allowing roller to be released from plug groove. Plug pops out and springs reseat valves. *The Hansen Mfg. Co.*

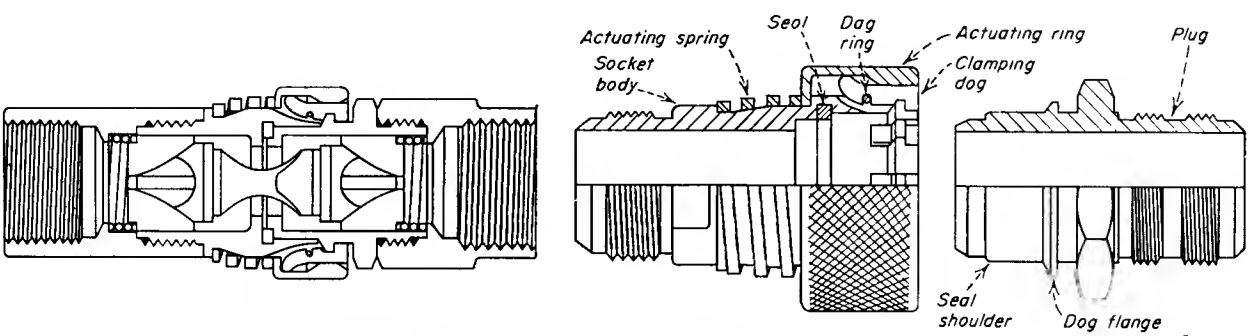


FIG. 4—Coupler for fluid and air lines that must be broken at frequent intervals. To connect or disconnect, the actuating ring is pulled back forcing dogs open. Plug can then be inserted or removed. Sealing is accomplished when actuating ring is forward, flush with ends of dog compressing plug into gasket. Coupler also designed for automatic disconnect at predetermined pressure in the line. *E. B. Wiggins Oil Tool Co., Inc.*

Couplings for Fluid Applications

matter. The units shown below are some of the methods presently being used to accomplish both quick disconnecting as well as automatic sealing of the broken lines.

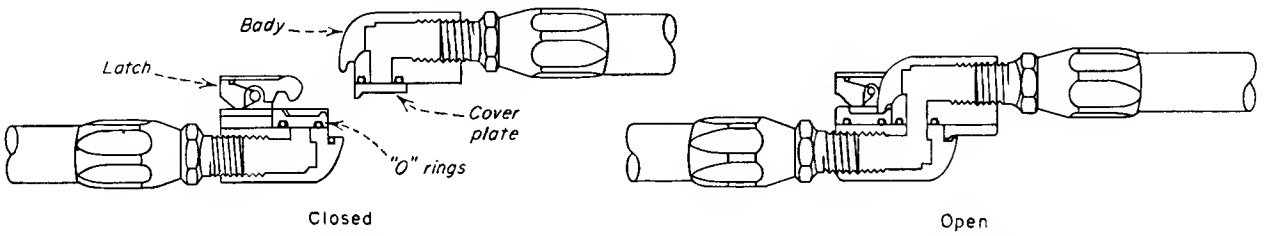


FIG. 5—Slide-seal coupler. Ports are closed by cover plates when disconnected. O-rings make a fluid tight seal. To connect, the mating lugs are matched and the halves pushed together. Cover plates slide back and latch locks. To disconnect, the thumb latch is depressed and a slight pull disconnects halves and closes ports. *Aeroquip Corp.*

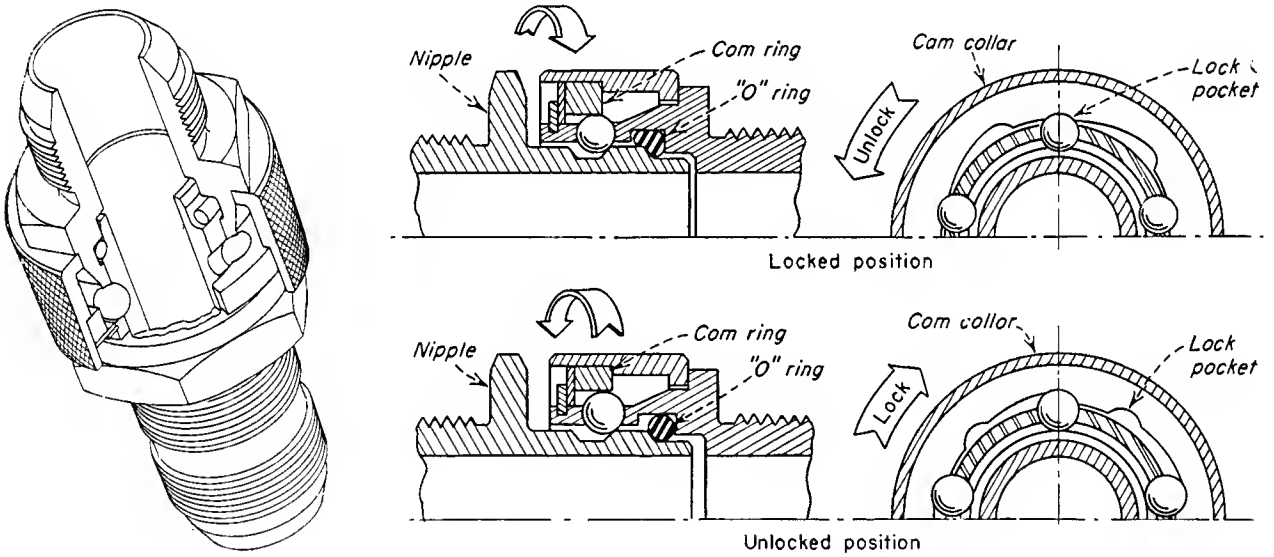


FIG. 6—Coupler uses the inclined plane and ball principle and has three major parts: a cam ring, a ball cage and a nipple or plug. Rotation of cam collar pushes balls inward into the groove, forcing halves together. Balls at end of cam travel drop into lock pockets. O-ring, in lock position, is compressed between coupling and nipple. Spring loaded valves can be added to make unit self-sealing. *Roylyn, Inc.*

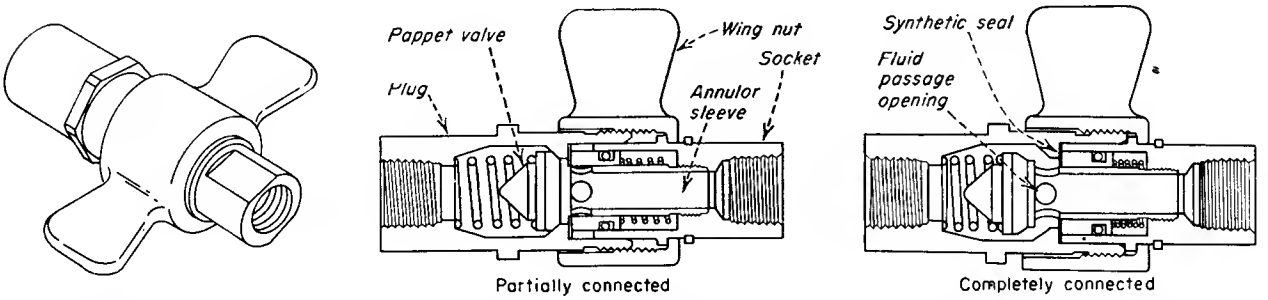


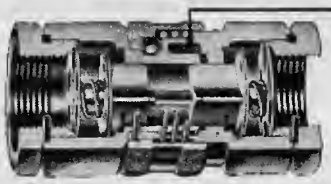
FIG. 7—Industrial coupler. Plug contains a spring loaded poppet valve. Socket has a spring loaded annular sleeve which slides on a tubular valve fixed to the socket. Tightening the wing nut draws halves together. Poppet valve and annular sleeve move, opening the fluid passage. Seal is compressed and fluid-tight. *Aeroquip Corp.*

WHICH SNAP-TITE QUICK-CONNECT COUPLING IS BEST FOR YOU?

SNAP-TITE "H" COUPLING . . . . FOR HIGH PRESSURE APPLICATIONS

FOR HYDRAULIC OR AIR

"H" Coupling for high strength, higher efficiency, high-resistance to heavy line surge. Sizes: ⅛" thru 12". Bulletin No. 240

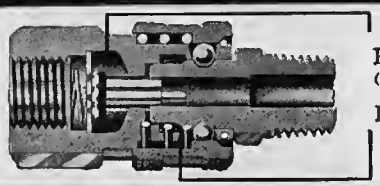


Exclusive U-packer gives a positive seal without compression set because of rubber distortion. Line pressure inside the U-packer keeps it open and forced against its metal backing—the higher the pressure, the tighter the seal.

SNAP-TITE HI-FLOW COUPLING . . . FOR LOW PRESSURE APPLICATIONS

FOR AIR AND FLUIDS UP TO 150 p.s.i.

Hi-Flow is recommended to connect small air tools to plant air system, and for low pressure fluid transfer in small lines.
Sizes: ⅛" thru ¾". Bulletin No. 230



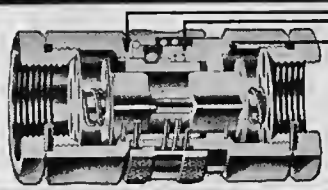
Bonded valve washer
(pat. pending on valve construction)

Exclusive U-packer

SNAP-TITE 'T' COUPLING . . . . . FOR HARD TO HANDLE FLUIDS

FOR FUMING ACIDS, ALKALIES, SOLVENTS . . .

'T' is the only coupling now on the market for fluid temperatures from −40°F to +400°F. Its seals are made of Teflon for which there is no known solvent.
Sizes: ½" thru 3". Bulletin No. 270.



Teflon Valve Seal

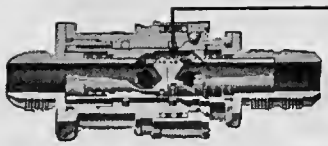
Teflon Nipple Seal

Teflon Valve Seal

SNAP-TITE NO-SPILL COUPLING . . . FOR MINIMUM AIR INCLUSION

FOR AIRCRAFT, MISSILE HYDRAULIC, FUEL SYSTEMS

which cannot stand air in the lines, and for transmitting fluids which *must not spill*, the Snap-Tite no-spill coupling is recommended. Bulletin No. 280

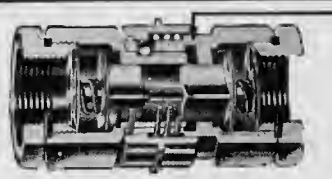


Flush valves prevent spillage, air inclusion. Snap-Tite will engineer special variations to your requirements.

SNAP-TITE "E" COUPLING . . . . . FOR VACUUM and VERY LOW PRESSURE

FOR VACUUM SYSTEMS IN THE MICRON RANGE

"E" Coupling performs in the *micron* range in the smaller sizes both connected and disconnected. Recommended, too, for gravity flow . . . U.L. approved for LP Gas.
Sizes: ⅛" thru 12". Bulletin No. 250



Nipple seals in coupler by depressing the lip of the E packer and slightly compressing the body of the packer. This new E-packer gives positive seal under high-pressure, low-pressure, and vacuum.

Snap-Tite Couplings are available plain, (without valves), and with either single or double shut-off. Couplings normally furnished in alloy steel, but all (except hi-flow) are also available in brass, aluminum, or stainless steel with a variety of finishes.

SNAP-TITE, INC., UNION CITY, PA.

Snap-Tite

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

Product Engineering — Design Digest Issue